Concrete

Vol. 21 *Detroit, August, 1922* *No. 2*

The Cement Market

AS an indication of the volume of concrete construction now under way, it is interesting to note that shipments of portland cement for the month of June are reported by the United States Geological Survey as 13,470,000 bbls., 2,225,000 bbls. more than the reported production for the same month last year. Reports from the various localities where cement is manufactured are that the mills are practically all producing at full capacity.

As cement is stocked in large quantities only by the producers, shipments in excess of production indicate that more cement is actually going into concrete construction than is being produced. Under normal conditions, with ample supplies of coal and necessary shipping facilities, the producers can draw on the stock on hand during the active construction season, and again fill their stock houses when the seasonal demand drops off. Just how the balance will work out under present conditions of the coal supplies and the railroads, it is difficult to estimate.

A number of the eastern cement mills reported sufficient coal on hand to permit capacity clinker production at least to August 1, and one mill in the central district has stopped burning clinker because of lack of coal, with other mills in the same locality facing the necessity of a shut-down within a month unless the coal supply is replenished.

With the signs pointing to an impending congestion on the railroads, it is a question whether the demands for cement on the job can be met even if the cement manufacturers succeed in getting the necessary coal to permit replenishing stocks of cement that are now being depleted.

* * *

Know Your Own Products

A READER of this magazine asked us to send him information which would aid him in convincing fire underwriter representatives that his concrete block should be admitted on a better basis of insurability.

We have no reason to doubt that this reader of CONCRETE is making good quality concrete block. We have no proof that he is doing so. If *he* has proof that he is making a good quality of concrete block he is one of a very small percentage of concrete block manufacturers who have such knowledge. Most concrete block manufacturers find enough satisfaction in rapping a block with a hammer; beyond what they assume to be the ring of soundness, they don't know what kind of block they are making. It doesn't fall down; they don't have any serious complaints, and they take it for granted that it is good block.

Underwriters don't take things for granted that way. There may be cited in the files of this magazine repeated instances of the failure of concrete block under fire, just as there are other instances, a great many of them, of the satisfactory performance of concrete block under severe fire exposure.

The underwriters and the building authorities are likely to be skeptical. They know that some concrete block go to pieces in fire. They don't burn up, but when the wooden interior of a building goes through under fire attack and the walls left are not fit to be built on again, and sometimes the block are not fit to be re-used in a new wall, they are inclined to *believe the worst* of most block which they are asked to insure. They don't judge it by the best examples. They are bound to consider the worst. It does no particular good to complain about this situation. The first thing to do is to support the movement which is being carried forward under the direction of a committee of the American Concrete Institute to have fire tests conducted by the Underwriters Laboratories, Chicago, and learn what standard of concrete block will give a satisfactory account of itself. When it is known what standard of block will show satisfactory fire resistance, the underwriters will have something upon which to base their judgment. Then when the individual manufacturer is able to show that he is making block up to such a standard, he will stand a much better chance of convincing the underwriters of the favored position his product is entitled to with respect to fire insurance. (Several hundred dollars are still needed to complete a $6,000 fire test fund—have you subscribed?)

When the fire tests are made, it will still be up to the individual local manufacturer to establish the quality of his block. That is why we cannot repeat too often the importance that the local manufacturer know what kind of block he makes.

There is no use in saying that concrete block are fireproof. Sometimes they are and sometimes not. The question is: *Are your block fireproof?* It stands a man well in hand to know his own products and what can be done with them.

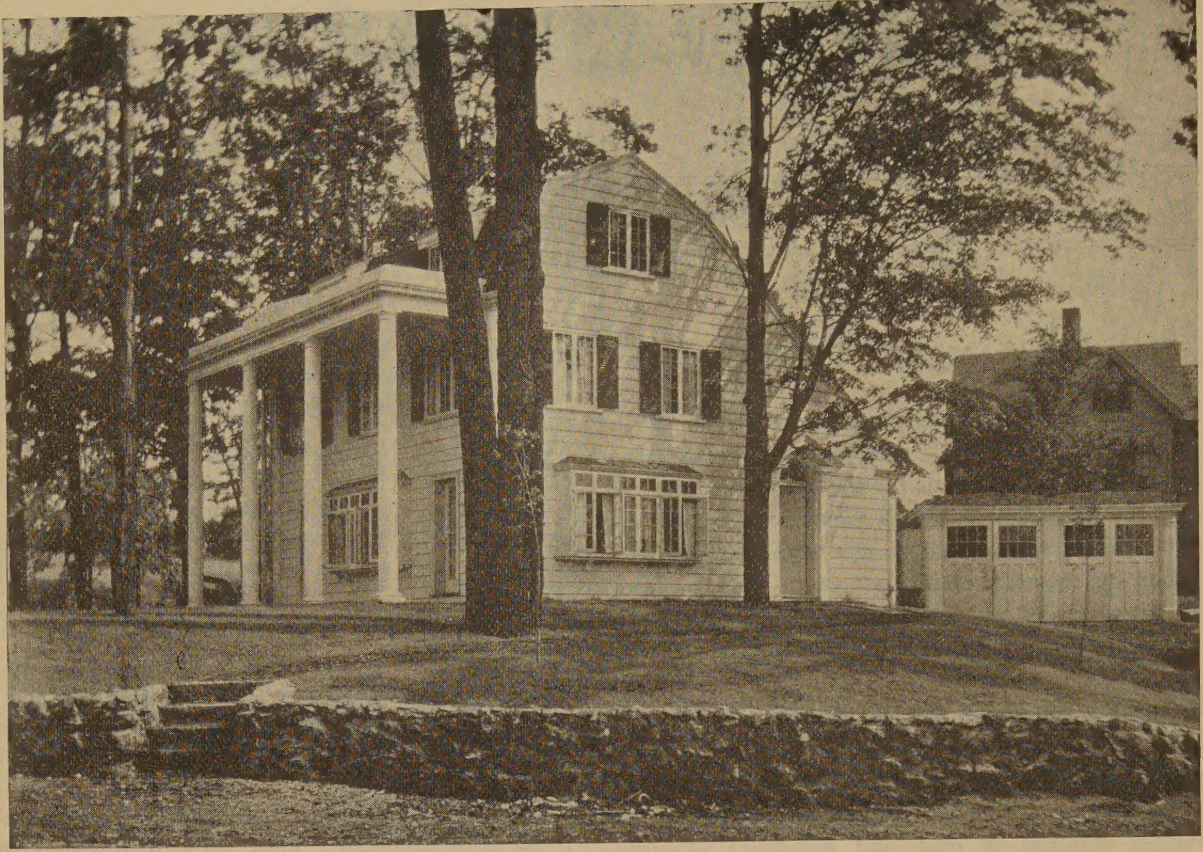


FIG. 1—A NEW ENGLAND COLONIAL FARM HOUSE ON COMMON STREET, BELMONT, MASS.—BUILT OF REINFORCED CONCRETE BY BATES & WIGGLESWORTH CO., ARCHITECTS, ENGINEERS AND CONTRACTORS—WALLS, FLOORS, ROOF, STAIRS OF CONCRETE—ROOF SHINGLE AND DROP SIDING EFFECTS, GUTTERS, MOLDINGS, CORNICES ARE OF CONCRETE MONOLITHIC WITH THE STRUCTURE AS A WHOLE

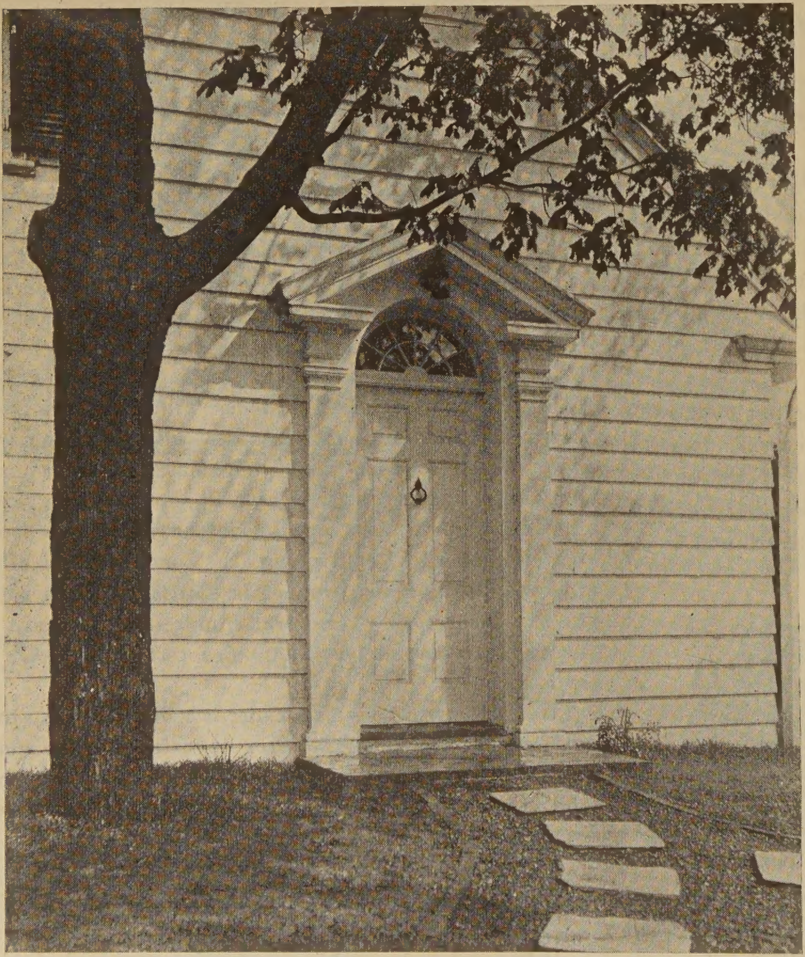


FIG. 2—DOORWAY, BATES & WIGGLESWORTH HOUSE

All the work shown is of concrete except the door and sash above, which are of wood. The doorway is a very close copy of an old one at Deerfield, Mass., built about 1740. Note the knocker which, when turned, lifts the latch inside, as can be seen by the picture of the hall. It is a copy of the latch and knocker of the Ironworks house at Saugus, Mass., probably built about 1640. Appreciation is expressed of the work of Edward Guy, of Saugus, the smith who made all the old-fashioned hardware, including the hinges, old-fashioned latches and electric fixtures.

Monolithic Concrete Architecture

With Special Reference to a House on Common Street, Belmont, Mass.

By Victor H. Wigglesworth
Architect, Belmont, Mass.

Monolithic concrete in the construction of distinctly architectural and monumental work is a field which up to the present has practically been ignored, or at all events undeveloped. Its possibilities would seem to be generally unrecognized. Certainly they are unemployed.

Considering the reasons that have been responsible for this condition, cost of construction under methods generally employed, unquestionably plays a major part; second, though hardly of less importance, is precedent. The two are so interwoven, precedent largely responsible for present costs, that they are hard to separate. Sufficient to say that first cost of concrete is greater than wood, and particular emphasis should be laid on first cost. Present costs, due largely to the method of pouring large units at one time, with the resultant high overhead in form cost, under different methods may be greatly reduced—reduced to a point where the advantage of concrete construction so outweighs the cost increment that it becomes of secondary importance.

As to precedent—clinging to familiar methods. Practically all those familiar with handling concrete are structural engineers or contractors, who have no great interest in architectural or monumental values, and who consider the handling of concrete in only its simplest of forms for the sake of economy. The engineering and contracting point of view alone has accordingly been developed, and has well proved such merits of concrete as are clearly shown by the very successful business in factory development of today—unquestioned by all, even the general public—as being of the best type of construction. This type has been developed where cost has not been the prime factor. The nature of the business, or building laws, has necessitated first-class construction. Concrete, with its manifest advantages, has been the solution. But what of residences, stores, banks, not to mention school buildings, where of all places a fire-proof construction should be the essential?

From time immemorial precedent has retarded progress. The established order hangs on with a tenacity which at times approaches that of the proverbial Old Man of the Sea. We have an army of men able to obtain artistic results in wood, but to achieve architectural effect in concrete we must have the combination of the architectural ability, plus the technical knowledge of concrete, plus an originality and confidence which will connect the two. For this type of construction the architect has been too much of a specialist, and the same is true of the contractor. The two must combine, or each must develop.

If concrete typifies the very finest in the construction of factories and business property, why has it not been more extensively developed for houses and schools? Simply that these must be monumentally or architecturally good, and the architect has not been put to work with the engineer and contractor to develop the tremendous opportunities that lie in that field. The factory and business type of construction represent an extremely small percentage of the building industry, yet that small percentage has risen to the highest type, while the great balance of building, so far as concrete is concerned, has been allowed to lie dormant simply because engineers and contractors have not included architectural ability in their system of development. Until this is done, that field will be stagnant, since for the great bulk of the building industry the public requires the service of an architect that it may have the privilege of enjoying a structure that has beauty and proportion. The individual may not demand this in his factory, but he does insist that it be present in his house, bank, and public buildings. These he feels must be architecturally or monumentally good. While some few concrete dwellings have made their appearance, for the most part these have been of the box-like construction, built for their commercial possibilities, rather than as homes in the true sense. This has largely educated the home-building public to conceive concrete construction as impossible of artistic treatment, forcing it to take a building of inferior construction for the sake of the essential characteristic—attractiveness.

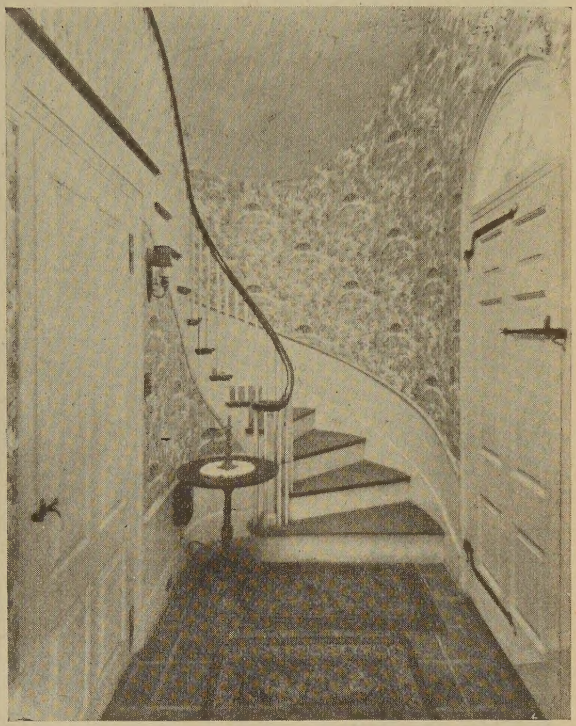


Fig. 3—The Entrance or Stair Hall

The stairs were built of concrete and finished with wood. The circular walls were all of concrete, plastered with two coats. The long slant roof intersected with the circular walls. The white dado was just the plastered wall painted. When the lines at the dado and at the ceiling are considered, it can easily be seen, as they represent the concrete work, what excellent workmanship was obtained in the construction.

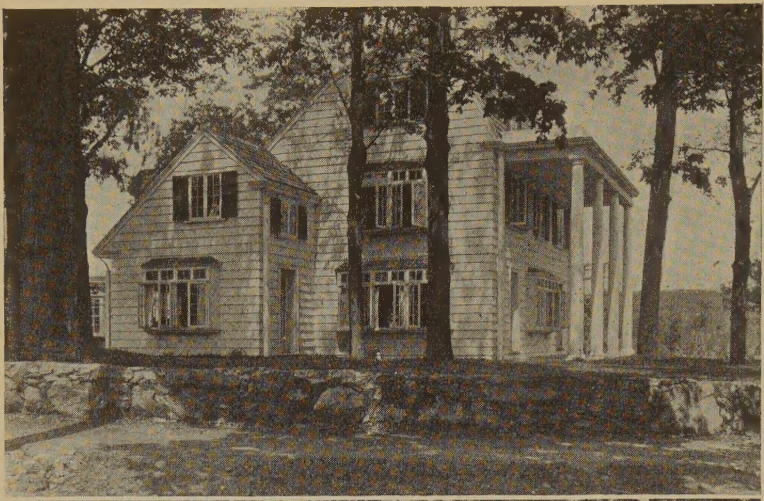


Fig. 4—View from the Main Street, Showing Again the Beautiful Alignment of the Columns

The elevator seen through the columns is across the street, where Bates & Wigglesworth are erecting another house of the same construction, but of a different design, one after the De Woolf Middleton House at Bristol, Conn. (about 1800).

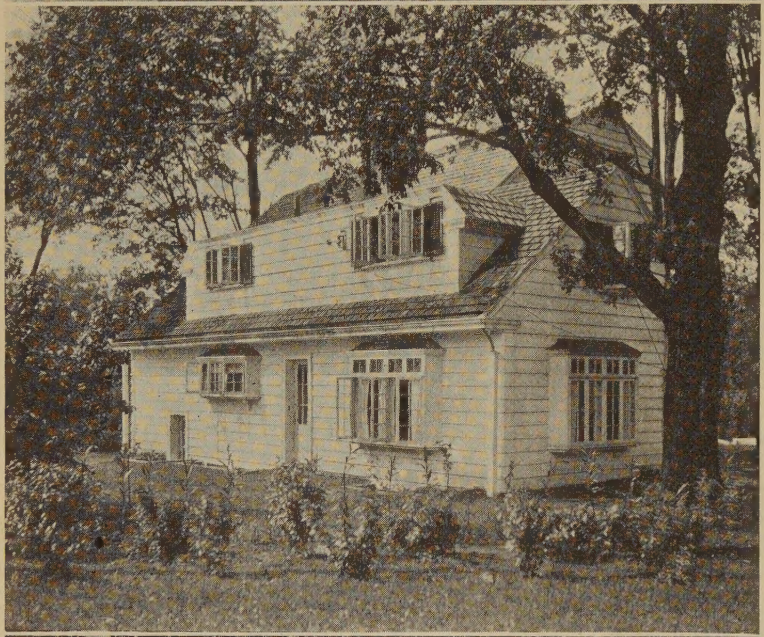


Fig. 5—View of the Roof, Showing Its Long Slant, with Its Shingle Effects

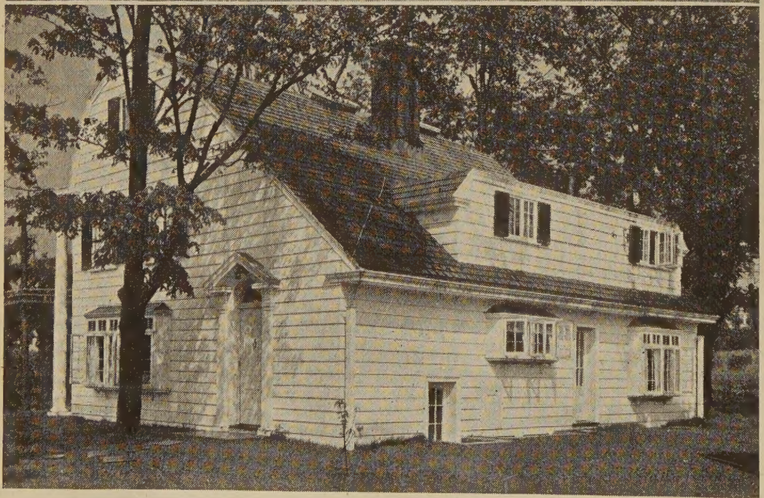
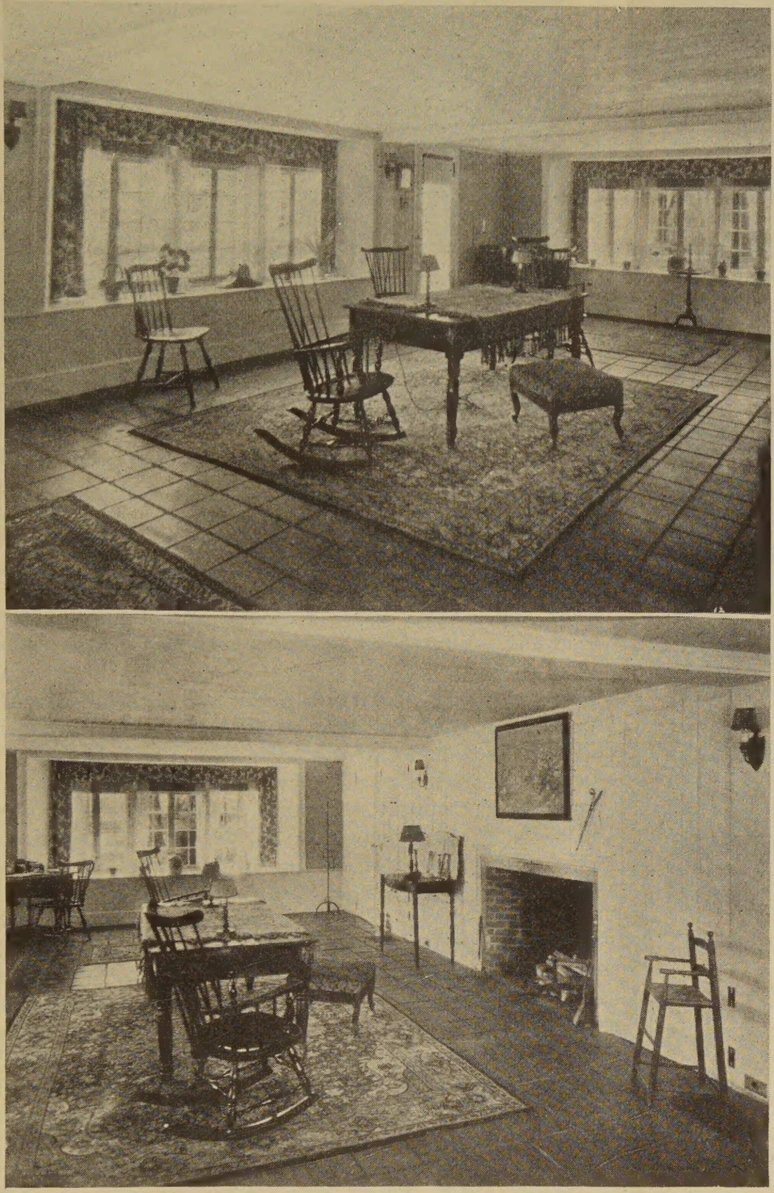


Fig. 6—Shingle Effects, the Intersection of Dormer Cornices with the Roof, the Concrete Gutters and Conductors, All Details of Interest

To the end that the tremendous possibilities of concrete in the field of dwelling school, bank construction, etc., may be realized, contractors and engineers must not assume that they have architectural ability. Architectural appreciation requires special training. The contractor who builds knowing he lacks architectural training, is by so much delaying a development which is inevitable.

While the artistic treatment has been emphasized as a prime requisite, of no less importance is technical knowledge of the concrete itself, and perfection in this line has been tacitly assumed. There is no room for the ignorant contractor, for poor quality work, a poor mixture, or other dishonest and false economies. There must be a thorough consideration of all construction details before building commences. This means minute detail plans. There must be provision for air space. The walls should be waterproofed on the outside. There must



FIGS. 7 AND 8—THE LIVING ROOM

Window seats, or flower bays, all features of interest. The outside walls consist of two 4-in. walls with a 2-in. air space. All of the first floor walls except the hall are painted—below, with dadoes of white; above, with walls of silver gray. The walls were plastered directly on the concrete, with two coats of portland cement mortar, then painted. The wood paneling is after the Roseneath Cottage, Hingham, Mass., seventeenth century. Back of the wood paneling is the concrete partition. The bearing partitions were 6 in. thick and the dividing partitions only 3 in. thick. The ceiling was plastered directly to the concrete floor above.

be careful and thorough reinforcing. We must work toward lower cost. A form scheme must be perfected which will permit the repeated use of small amounts of form material. All this will result in a carefully considered design of architectural beauty, with best possible construction, and construction considered, an economy which can be equaled by no other type. We will have a structure which cannot be surpassed for durability, noninflammability, economy. One which is free from upkeep cost, from mice and insects, one not only easily heated, but cool in summer—in short, approaching the ideal as nearly as may be hoped.

Notes on Construction

In putting into practice ideas of architectural development of concrete which Mr. Wigglesworth has outlined above, the Bates & Wigglesworth Co. has erected for Mr. Wigglesworth's occupancy the house which is shown in the accompanying illustrations, from photographs and plans.

Attention was directed briefly to this work when it was nearing completion, in the January, 1922, issue of CONCRETE.

Scarcely anyone would guess from looking at the photographs, or even from a casual observation of the house itself, where it stands on Common St., Belmont, Mass., that this much-favored type of New England Colonial farm house is entirely of concrete—the double walls, the floors, the stairs, the roof, even the tile which form the roof surface—all monolithic with the slab.

Mr. Wigglesworth may be said by some to be flying in the face of a common architectural conception that a structure should express the material of which it is made. He stoutly maintains, however, that since the old New England farmhouse, with its drop siding and its fine moldings is a design that is good for its own sake, for its simple lines and proportions, regardless of the material, and that this design, drop siding, moldings, and all deserves preservation in a permanent and worthy material.

A minimum of forms was used. Two-inch plank panels about 2 ft. high, very carefully dimensioned, were built up in reverse of the wood drop siding, various fine details being produced with reverse moldings and most painstaking workmanship.

The wall forms were used over and over again, the concrete being placed in small batches from hods. Mr.

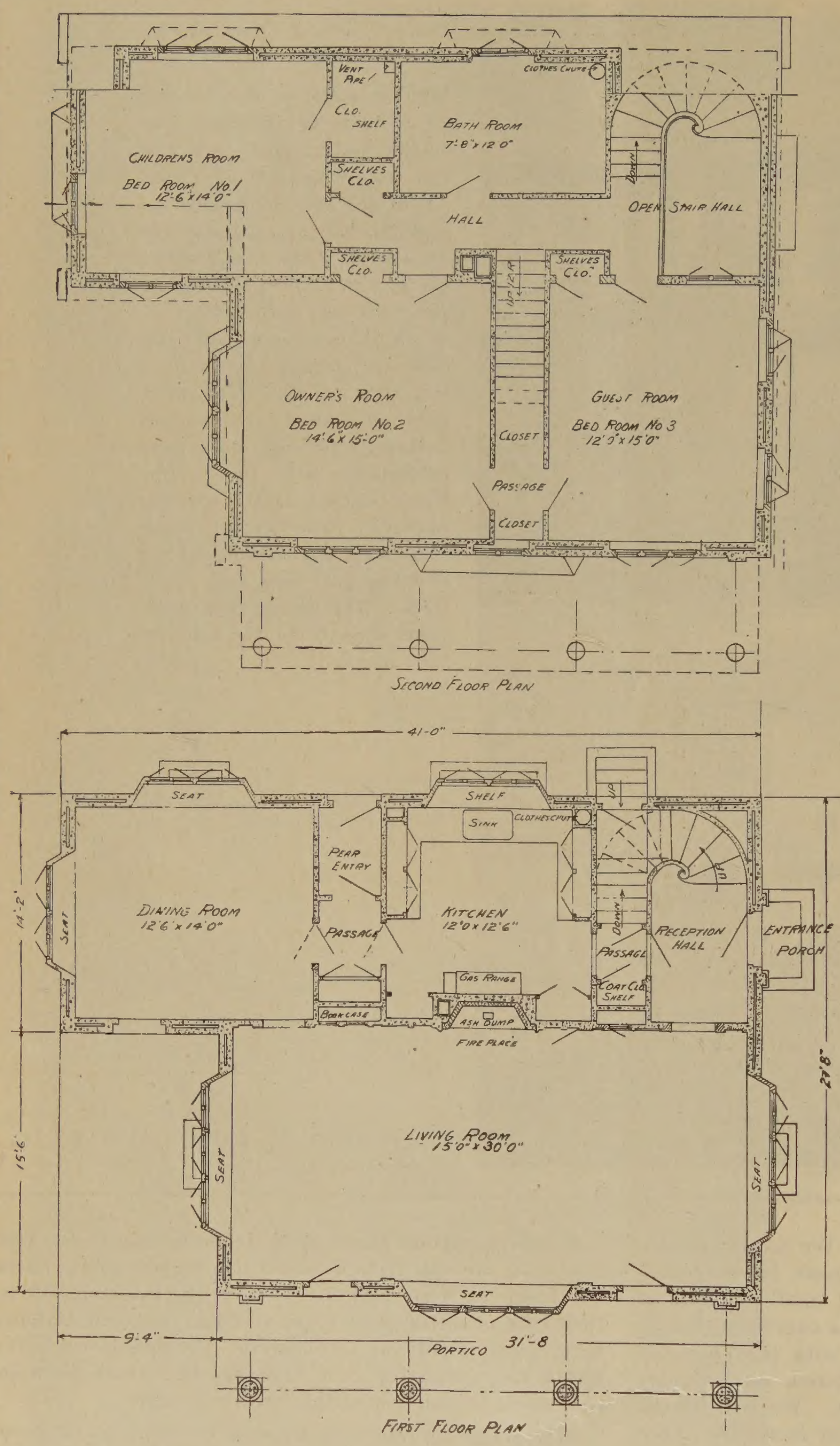


Fig. 12—Plans of First and Second Floors

Wigglesworth points out that success with the work was due to the fact that the entire form work was very carefully drawn out and that the height of each plank had a particular relation to the modeled surface required and again that all planks were always level and true. Particular stress was put upon absolute conformity to the drawings of the forms which were worked out in minutest detail beforehand. Each course was considered 7 13/16 in. high and no deviation was permitted. The four large columns were poured before the work on the walls was up to the under side of the beam. "If we had not followed dimensions absolutely the bottom of the beam the edge of the siding would not have lined as shown in one of these illustrations," says Mr. Wigglesworth. It will also be noticed in another illustration that the top of a pilaster lines absolutely with the siding, that the top of the cornice lines with the siding and following the main cornice it will be seen that it lines absolutely with the siding and the cornice of the doorway. The doorway form was set up entirely when the first floor was poured. Mr. Wigglesworth asserts that there is nothing new in the form work, simply the idea of using planks over and over again for the sake of economy. Careful planning gave much lower costs than would be supposed. Mr. Wigglesworth reports that it was only 10% more than for similar construction with wood. Subsequent work along similar lines indicates that costs will be possible at about 6% more than wood, ad-

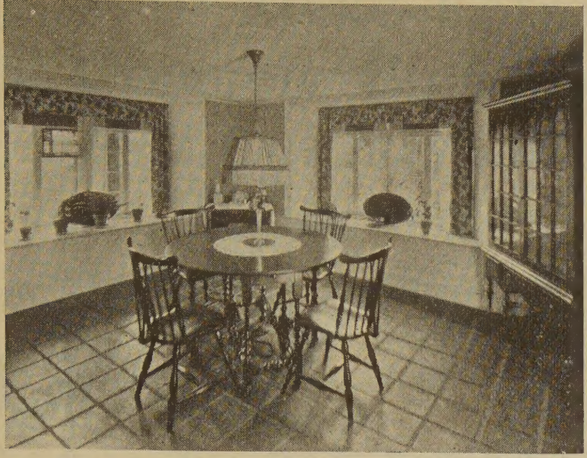
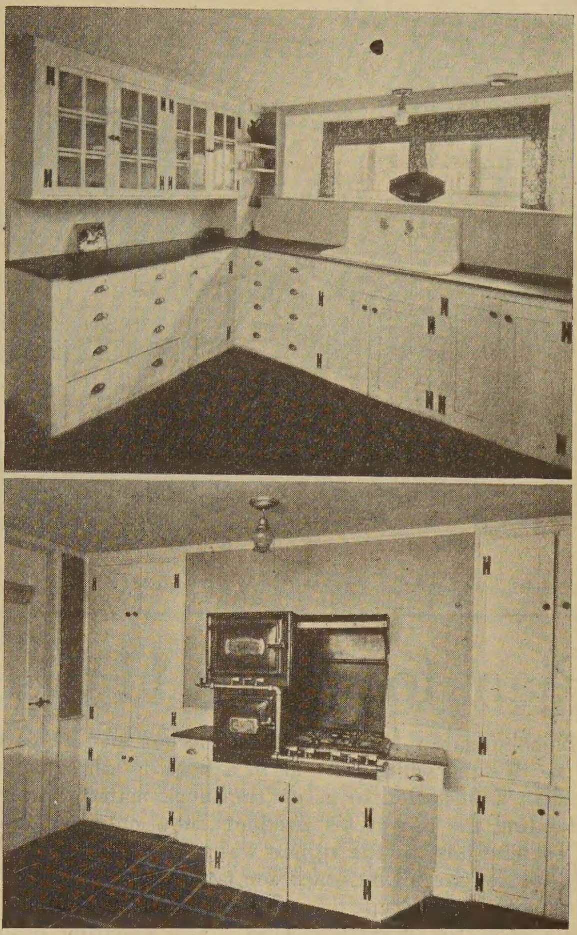


Fig. 9—The Dining Room

The same treatment used as that of the living room for the walls, with the same 9 x 9 deep red tiles, which were used for the first floor.



Figs. 10 and 11—The Kitchen

All the fitments were built in using all old H hinges for the cupboard doors. Fireproof construction allowed setting the gas stove directly into the wall, saving space. It is vented directly into the fireplace flue.

ditional saving being brought about by further form economy and by greater economy in handling the concrete.

The mix used on the house illustrated was a 1:2 mortar with as much 1 in. stone crowded into it as could safely be done and still preserve the surfaces. In the outer shell of the double wall the mix was nearly all mortar thus giving quick hardening results. The forms were carefully removed the next day after pouring or two days following. Most of the lines were very near perfection. Mr. Wigglesworth points out that the perfection of the surface before its final rubbing with carborundum can best be realized when it is mentioned that owing to the cold weather when the job was being finished a portion of the portico wall of the front was not patched nor rubbed but it was painted on just as the surface came from the forms. Most of the surfaces, however, were carefully patched, rubbed with carborundum and the surface finally finished with one coat of Wadsworth Howland's white Bay State cement coating.

In the construction of the roof forms were the same as used to produce the siding effect with gouges in the face about 8 in. on centers, to gain the shingle effect. The roof was covered with similar paint to that on the walls, but in a slate color.

The use of bamboo reinforcement in concrete construction in Japan is reported by the American consul at Nagasaki. An employee of the Department of Communications of the Japanese government has decided to construct a new telephone exchange building at Hakata-Fukuoka, Kyushiu, of bamboo, generally known as Mosochiku. The proposal to reinforce concrete with bamboo originated from the fact that bamboo becomes putrefaction-proof by the use of a certain chemical, and is relatively fireproof. The concrete reinforced by bamboo is reported to be of much more economical construction than ferro-concrete, its cost being only half, and the cost of transportation of the cane also very moderate.

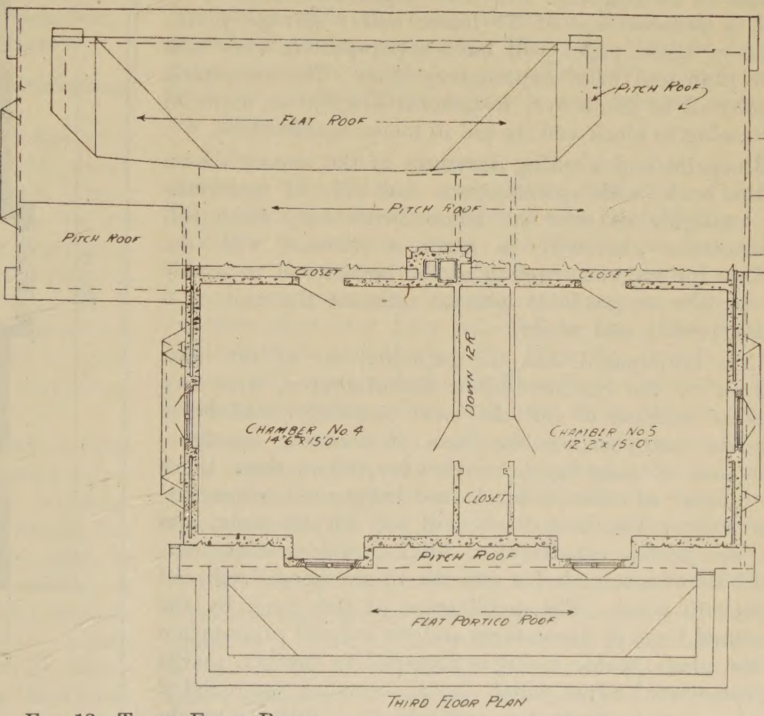
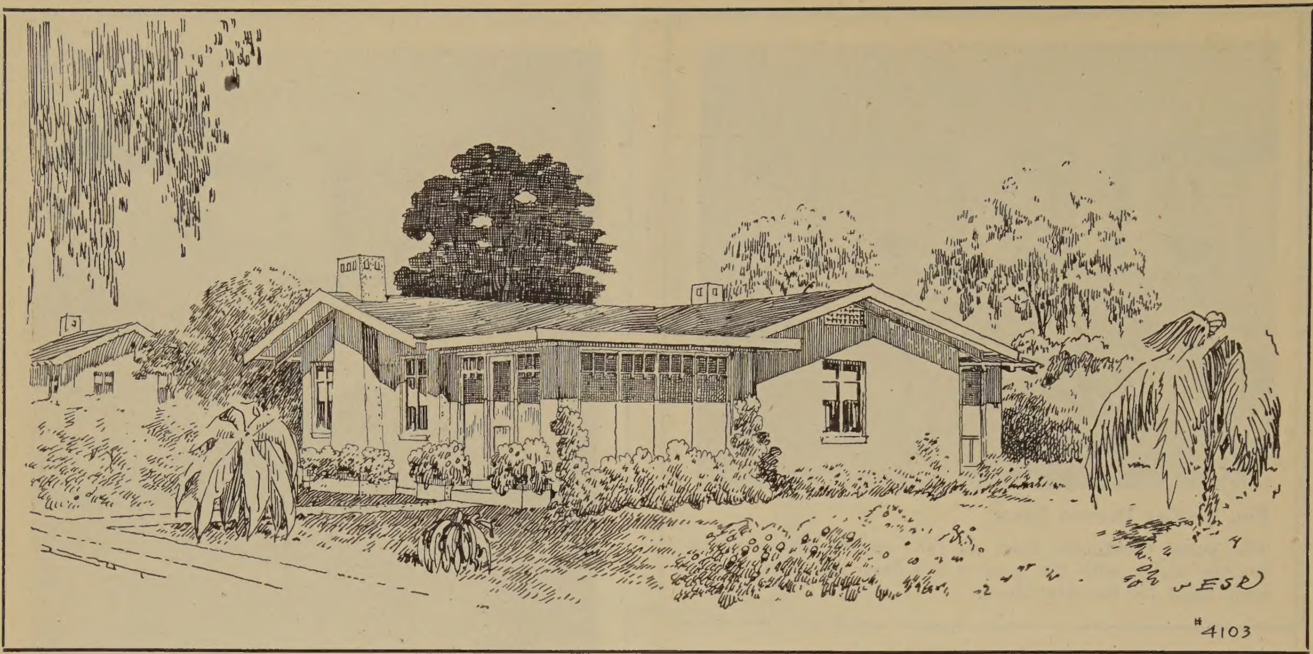


Fig. 13—Third Floor Plan



Plans for Block Houses

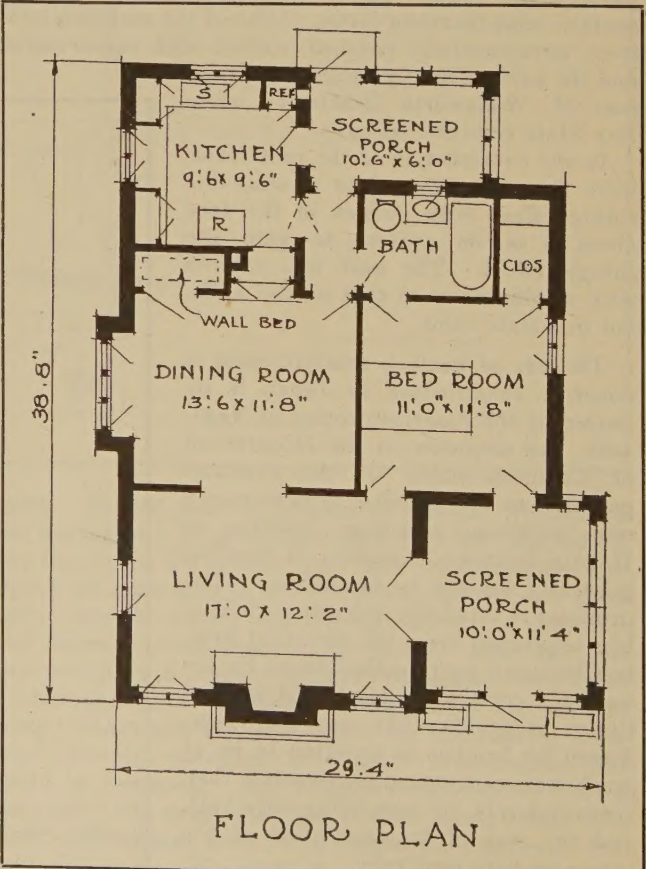
The bungalow shown in plan and perspective is one of 25 designs being put out in a book by the Portland Cement Association to assist the block manufacturer in extending the use of his products, now chiefly confined to foundations, to the upper walls of dwelling houses. The houses are all designed for the most economical use of the commonest type of concrete block, 8 by 8 by 16 in., plain face, for stucco covering. The dwelling designs include various sizes, from four rooms to seven rooms, bungalows, story and a half houses, two story houses, and in several popular styles, including New England Colonial, Californian, English, Dutch Colonial, Italian, Western and others, giving a very wide range from which to select.

The book which the association is putting out will consist of 34 pages, of which 26 pages will be occupied with a presentation of 25 house and 3 garage plans. Each of these pages will have a perspective view and floor plan and brief explanatory text. The remaining pages will be given over to general descriptive material pertaining to block and its use in house construction.

Blueprint and working drawings of the houses shown in the book, with specifications and bills of materials, are available so that the home owner may have full information wherewith to place a contract with the builder for the construction of the house, and to enable the builder or products man to estimate the cost of a house quickly and easily.

It is anticipated that the principal use of the book will be by the concrete block manufacturer, who may thus be enabled to sell the local contractor and home building prospect on the idea of concrete construction, thus opening up the market for two or three times the number of concrete block now being used in foundation work. The book itself will sell for 50 cents, and the blueprints, construction details, and specifications and bills of materials for any one of the houses will sell at $10.00 a set. The publication of this book by the Portland Cement Association and the careful preparation of the plans, whose use it is intended to further, marks a promotional effort which should be much appreciated by the concrete products manufacturer as filling a much-needed means of promoting the use of his product, in having available to show the prospect plans well drawn and well thought out in every detail by architects especially selected for their fitness for the problem involved in the use of this particular material.

The Bureau of Standards, in co-operation with interested manufacturers, is to carry out an investigation of stucco bases made of woven wire cloth and expanded metal lath. It is expected that three types of base now in general use will be applied over sheathed construction, and the performance of the various panels will be noted and analyzed.



How to Make Forms for Concrete Buildings —*Belt Courses and Cornices*

The Sixth Article of a Series for the Builder Who Wants to Know the Subject From the Beginning

By William F. Lockhardt
Lockhardt-Byrne Co., Inc.
New York City

Articles on forms for Footings, Columns, Walls, Beams and Girders and Flat Slabs, have been published in six previous issues, beginning February, 1922. The article on Flat Slabs appeared in two parts in June and July. The present article on Forms for Belt Courses and Cornices completes Mr. Lockhardt's series for the time being. Mr. Lockhardt's descriptions of form work are based on the actual practice of some of the most successful concrete building contractors in the United States. Various methods have been tried, and these methods have survived. If any reader is in doubt about some step in form building, when he has read Mr. Lockhardt's article on any one of the special subjects in the series, he will be conferring a favor on the editors and on many readers if he will ask to have the point more fully explained. A reader who has used form building methods different from the methods here described, and which he believes better for any reason whatever, will be adding something to the consideration of a very important subject if he will describe those methods for this magazine.—The Editor.

Nearly every building, except the plainest and most economical structure located in large industrial developments away from the public eye, boasts some degree of architectural design, usually expressed with the aid of belt courses and cornices. Inasmuch as every conceivable combination of architectural moldings is possible in these forms of ornament, it is out of the question to attempt to give hard and fast rules for the construction of the necessary forms, so that these notes will be more with regard to things to look out for which may cause trouble if neglected or overlooked.

Belt courses are usually located at the second or third story of a building, and again one or two stories below the cornice, depending on the height of the building. A general type of high building architectural design has been pretty well adopted by architects, and may be used as an example. The building, by this method, is likened to a column, having a base, a shaft and a capital. Applied to the building, this gives us a heavy plinth or base, one or two stories high, a long plain shaft, which is the main part of the building, where the floors are generally typical, and the architectural design, if any, is repeated on each floor, and a capital. The "capital" is generally one or two stories high, above a second belt course, and is most usually crowned with a cornice and parapet.

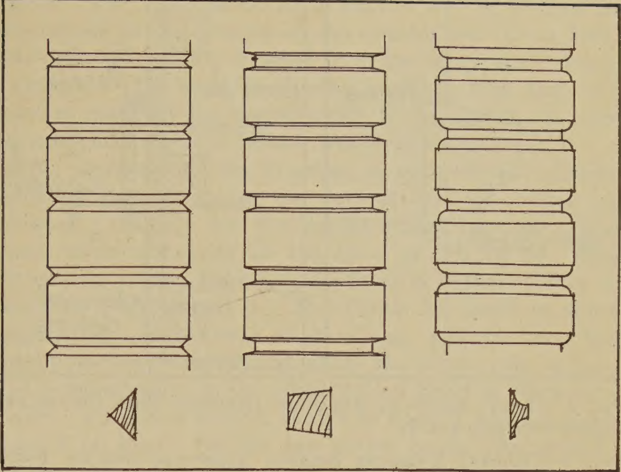


Fig. 1—Part Elevation of Columns, Showing Different Column Markings and the Molding Required to Form Them

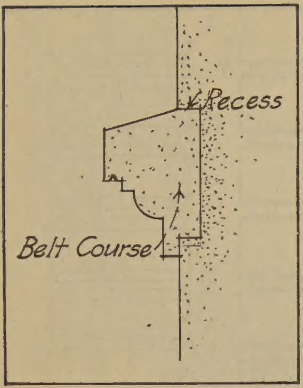
To get the effect of a heavy base, the columns in the first story are often marked off into blocks to simulate masonry with recessed joints, by inserting wood strips in the column forms at the right locations. The three effects most frequently used are shown in Fig. 1, which also shows the moldings required to get the marking pictured. The first type, the *V* marking, is obtained by using the ordinary "skewback," the triangular wood strip used to bevel off the corners of columns and beams. The other two types require that the moldings be run specially at the mill. These moldings should, of course, be ordered far enough ahead of actual requirements to allow for the usual delays in delivery without holding up the concreting of the first story columns.

Unless the column is very high, so that the moldings are likely to be dislodged by the falling concrete, some carpenter foremen prefer to nail the moldings to the forms very lightly, so that when the forms are stripped the strips will pull away from the forms and remain embedded in the concrete. They can then be left in place until the concrete has set sufficiently to enable them to be removed without injury to the delicate edges of the markings.

Reference to the drawing will show that all three markings are of such a character that they will free themselves readily from the concrete in stripping.

When the column forms are hoisted to the second floor any strips remaining on them are removed and the forms gone over with a scraper to remove any fins of concrete that may have adhered in the joint between the moldings and the panel. This fin, if left on the forms, will cause a slight marking on the columns of the succeeding stories, which will have to be pointed up.

At the second floor, or immediately above it, the first belt course will probably be required. It is usually impractical to attempt to cast this with the columns, so recourse must be had to recessing. A recess similar to that shown in Fig. 2 is employed, 2 in. deep, the full width of the column, and with a vertical dimension about 2 in. less than the overall vertical dimension of the belt course or cornice, to allow the bottom of the belt course to conceal the joint with the bottom of the recess, which would otherwise be visible, particularly if all the recess boxes were not set at the same level. Fig. 3 is a vertical section through the outside face of a column form, show-



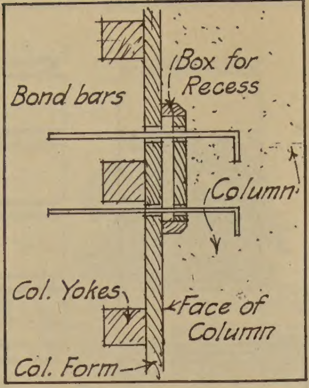


Fig. 2—(Left) Showing Relation Between Belt Course and Recess Provided for It

Fig. 3—(Right) Vertical Section Through Column Form, Showing Recess Box in Place Against Face of Forms

ing how the recess box is built up and attached to the inner face of the form panel.

When this is done it is necessary that provision be made to retain the belt course against the face of the building. This is accomplished by boring holes with an extension bit through column form and box together, and then inserting bond-bars as indicated in the drawing. The number and size of the bars, as well as their proper location are usually determined by the designing engineer and their position indicated in the drawings.

The method of building and supporting belt course forms is practically the same as for cornices, which will be described later on. The undercuts, however, are usually less, and consequently less "clearance," as we call it, is required.

Before taking up the actual construction of the forms themselves, one or two general notes should be given attention. It is important to remember that belt courses are frequently viewed from a moderate elevation, such as a different street grade, etc., which makes it possible to sight along the members and detect irregularities. Care must be taken after the forms are up to see that they do not warp or sag out of line or elevation.

One of the most common defects in belt course form work is that of allowing the forms to sag while the filling is going on. When concrete is being placed a man should be kept at work continuously checking up for line and elevation and keeping the forms where they belong. A very slight sag in a belt course in a 20-ft. bay becomes painfully apparent to any one sighting along the moldings after they have been stripped. Repeated all the way along the face of the building, a disagreeable impression is given as to the foreman's ability. A chalk line or fine wire should be stretched tightly from one end to the other of the proposed fill, and one man kept at work wedging up shores and tightening bolts as fast as may be necessary.

A cornice, being high above the street, cannot be viewed in the same way, and minor faults are not so conspicuous.

Another small but important item that too often escapes attention both in the office and in the field is the necessity for drip moldings below all large flat vertical surfaces from which dust or grime may be washed. A triangular drip molding is shown in Fig. 2 right back of the facia. When such a drip is omitted the accumulated soot and dust from the wash of the belt course will be carried down the face of the building, staining and streaking it badly. Because of the difficulty of forming the drip satisfactorily, where the soffit of the molding is very narrow, the drip is sometimes omitted, but if the appearance of the building, after it has been in use a couple of years is worth anything, this precaution should not be neglected.

A satisfactory drip can be formed by tacking a small triangular skewback to the forms, or a half-dowel may be used. The molding should always be so lightly tacked to the forms that it will come away from them when they are stripped and remain in the concrete until the masons clean down the face of the building. By this time it can be pulled out without breaking off the 1 in. edge of concrete outside it.

In regard to the setting of grades for belt courses and cornices a word or two may not be amiss at this point. It is practically impossible to measure up from the finished floor level at each column for such ornamentation and get a satisfactory job, as there will be enough variation in the floor itself to give the belt course a permanent wave. The best method is to run a grade all around the building, with an engineer's level, making a mark on each column three or four feet above the theoretical finished floor. The carpenter can then work from these grade marks with the assurance that if his form work is all right, his cornice will be level.

Belt course forms are most frequently built up in the yard in convenient lengths and set up in place afterward. The quantity to be made up for any given job will depend upon the size of the job, and the speed required to complete on time. As the forms are made of special moldings requiring expensive millwork for some designs, no greater footage should be built than is actually required. Generally the forms can be stripped in four days, so that knowing the total linear footage to be built and the time available for the operation, it is easy to figure the amount of cornice or belt course material to be made up.

Belt course and cornice forms are usually built on outrigger brackets built up on 4 by 4 posts, as shown in

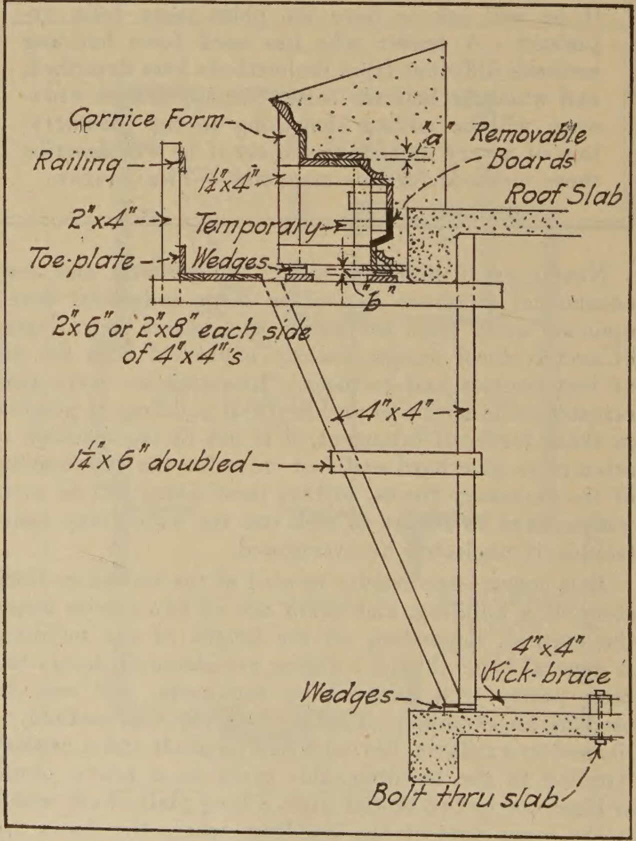
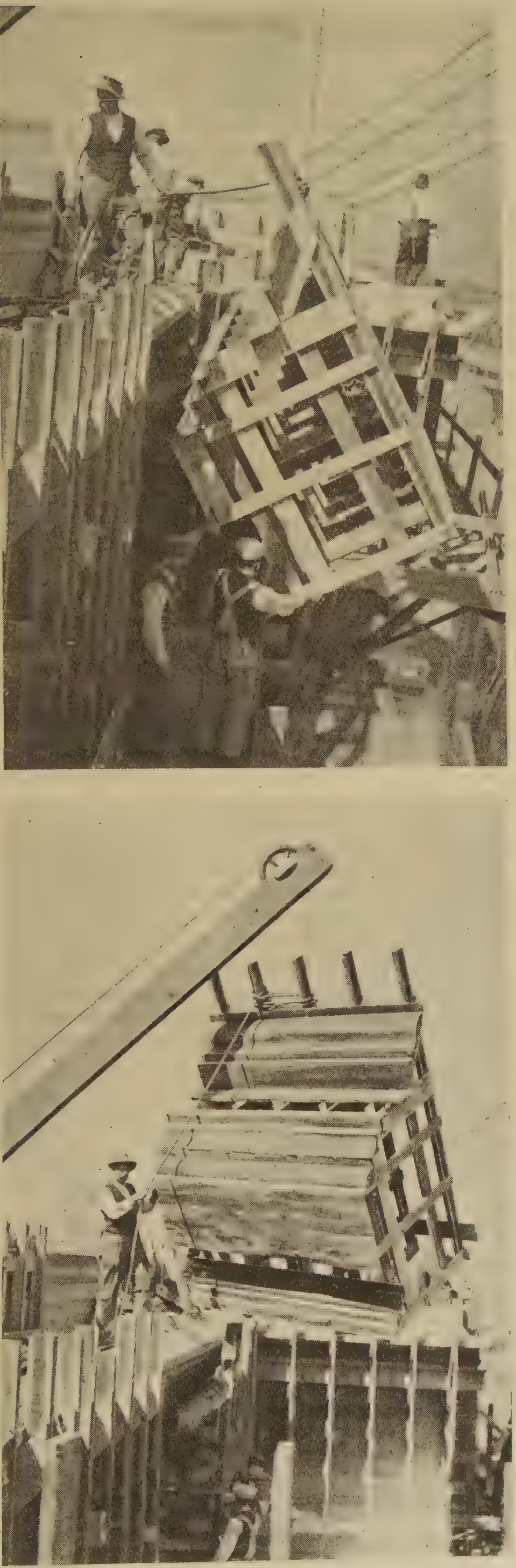


Fig. 4—Typical Method of Supporting Belt Course or Cornice Forms



Figs. 5 and 6—Cornice Forms 13 ft. High, with 4 ft. 6 in. Overhang

Fig. 4. The spacing of these shores will of course be determined by the weight of the cornice per linear foot, which can be roughly figured from the large scale detail drawings. The loads per post should be kept low, because so much of the construction is supported out over the sidewalk, where a failure would be disastrous.

The character of the framing to support the various moldings that comprise the cornice will of course be governed entirely by the architectural design. The frame work is usually of 1¼ by 4 or 1¼ by 6. This supporting frame for an exceptionally large cornice is shown in Figs. 5 and 6. The forms are built in short lengths for convenience in handling, and to keep the weight per section down to where the forms can be handled economically, as the construction itself is often very heavy. The form section shown in Figs. 5 and 6 is only about 8 ft. long. On the job shown in the photographs the cornice and parapet wall were 13 ft. high, and had an overhang of 4 ft. 6 in. The special derrick shown was used to swing the forms back inboard, where they could be trundled from one place to another.

The platform on which the forms stand is made wide, so that the forms may be moved far enough away from the building to enable the laborers to hoist them clear of the green concrete, after they are stripped. The forms should be set up on wedges so that in stripping they may first be lowered to clear any undercut portions, such as at *a* in Fig. 4. Thus, if dimension *a* is 1 in. the wedges at *b* should be, say, 2 in. for ample clearance.

Where the cornice is so designed that a molding of any kind projects from a wide facia, it will be necessary to build the forms so that this projection will not interfere with stripping, as the molding will prevent the forms from being lowered to clear *a*. This may be accomplished in several ways. The boards that form the soffit panel may be so lightly nailed in place that they will come free and permit the whole form to be moved forward; or the boards that form the top of the projected molding and the board immediately above it (which should be wider than the clearance required) may be held in place by blocking and taken out each time before an effort is made to strip. These are marked "removable boards" in the drawing.

Because of the very slight overhang found in belt courses, as a rule, it is not often that they have to be reshored after stripping, as they ordinarily stand. Cornices, however, are frequently badly overbalanced, and until the concrete has set up enough to make the reinforcement effective, care should be taken to see that they are reposted just as carefully as a floor. Where this is done the cornice may be stripped by sections, each section being carefully reposted before the next section is stripped.

Announcement is made by the Executive Committee of the Permanent International Association of Road Congresses that the fourth International Road Congress will be held in Seville, Spain, in May, 1923. This asso-progress in the improvement of highways and the efficient development of highway transport throughout the world, held its second congress at Brussels in 1910 and its third in London in 1913. The next congress will last for six days, and besides delegates elected by governments specially to represent them, individual and corporate members of the organization will be in attendance. The third congress, held in London in 1913, had an attendance of 3,793, of which 139 were from the United States. Fifty-two nations in all were represented at that conference, and forty-four governments had official representatives.

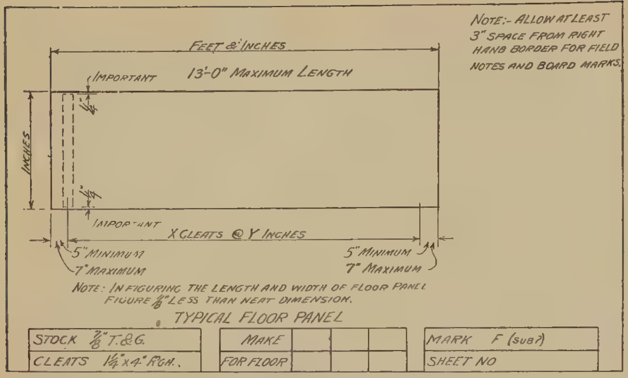


Fig. 1—Typical Floor Panel Make-Up Sheet

Forms for Flat Slab Floors

By G. W. Maker
Aberthaw Construction Co.
Boston, Mass.

An article by Mr. Lockhardt in the June issue of Concrete states that there can be nothing much simpler than flat slab forms, and suggests that any one of several ways of constructing such forms will be satisfactory and economical.

It is the writer's opinion, backed by experience of the Aberthaw Construction Co., that the apparent simplicity of this type of floor construction is apt to be misleading, and that its very simplicity leaves many opportunities for careful study of form design, make-up, placing and removal, particularly with regard to minimizing the number of sizes of panels, waste of lumber, and the assembly of the system to allow ease of stripping with the least possible damage to the lumber. This last point is most important, in view of the high cost of form lumber.

The design of forms for each Aberthaw flat slab building is made in accordance with the company's standards, rather than left to the ingenuity of the superintendent or carpenter foreman on the work, even though he may be experienced in the ways of the company. The Aberthaw book of form standards was developed to cover particularly the design, make-up, erection, stripping and removal of flat slab floor forms, but in a brief way also touches on forms for wall columns, beams, stairs, etc., which are ordinarily found in a flat slab building. The development of this book of standards was placed in the hands of competent engineers, who collected and compiled all available information from Aberthaw superintendents and carpenter foremen. The ideas of one were threshed out with the others; theory gave way to practice and experience, and the resulting standards, which are really the ideas of men whose experience in concrete construction ranges from 10 to 25 years, are, in the writer's opinion, as nearly 100% practical as is possible.

Furthermore, because these standards are largely the ideas of the men who daily use them, keen interest is taken in them, and suggestions for improvement are continually made.

The article above referred to states that floor panels may vary considerably in size, dependent on the size of the structure. Our experience has shown that there is one best size of panel, and accordingly effort is made to adhere as closely as possible to this size, without regard to the size of the building. Our book of standards states definitely, "Panels should never be over 13 ft. in length, and usually not over 4 ft. in width." In the writer's opinion the possibility of economy lies principally in the ease of handling panels, more than in any other single operation in connection with them. Panels are laid down by carpenter helpers, rather than carpenters. The amount of nailing over a given area is practically the same without regard to size of panel, and this item is accordingly not of great importance.

Fig. 1 is a reproduction of the typical floor panel make-up sheet in the Aberthaw book of standards. It will be noted that this goes into some detail, but in this way nothing is left to guess or judgment, and there is little opportunity for error. Written instructions accompany these illustrations in the book, with which all Aberthaw carpenter foremen and make-up men are familiar, and very full detailed explanations of these typical sheets are given. For instance, in the case of the typical panels shown, instructions call for the use of three 6-penny nails to hold the outside boards to each cleat, and two 6-penny nails for each interior board at each

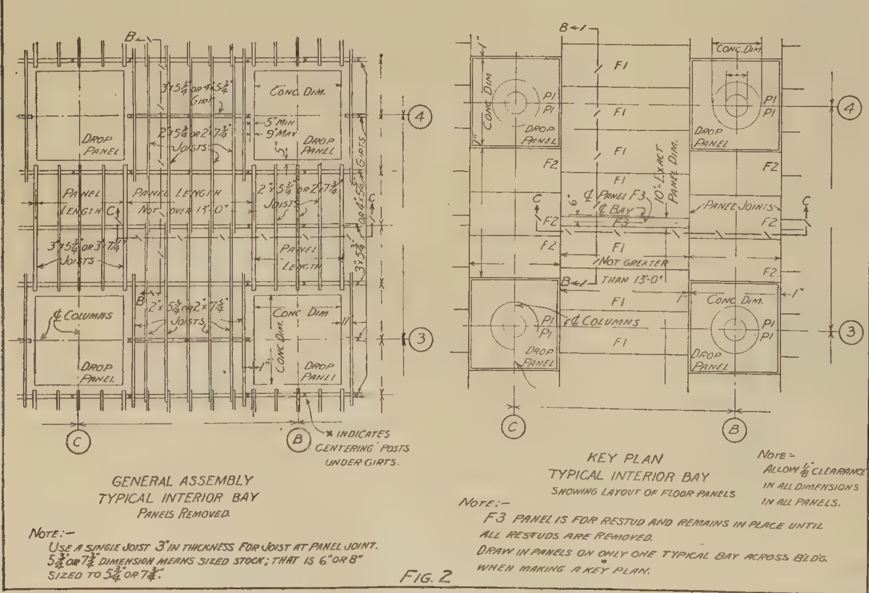


Fig. 2—Typical Assembly for Interior Bay of Floor Panels—General Assembly and Key Plan

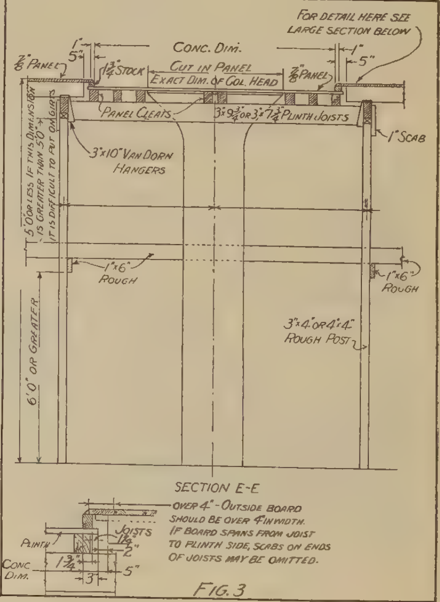

FOR DETAIL HERE SEE LARGE SECTION BELOW
CONC. DIM.
1"
5"
7/8" PANEL
1¾" STOCK
CUT IN PANEL
EXACT DIM. OF COL. HEAD
7/8" PANEL
1"
5"
PANEL CLEATS
3"x9¾" OR 3"x7¾" PLINTH JOISTS
1" SCAB
3"x10" VAN DORN HANGERS
5'0" OR LESS IF THIS DIMENSION IS GREATER THAN 5'0" IT IS DIFFICULT TO PUT ON GIRTS
1"x6" ROUGH
1"x6" ROUGH
6'0" OR GREATER
3"x4" OR 4"x4" ROUGH POST
4
3
SECTION E-E
OVER 4" - OUTSIDE BOARD SHOULD BE OVER 4" IN WIDTH.
IF BOARD SPANS FROM JOIST TO PLINTH SIDE, SCABS ON ENDS OF JOISTS MAY BE OMITTED.
JOISTS
PLINTH
1⅞"
2"
1¾"
CONC DIM.
3"
5"
FIG. 3

Fig. 3—Assembly for Drop Panel Around Column Head

cleat. The exact location of each cleat with regard to the edges of the panel is also shown.

The typical assembly for an interior bay of floor panels is shown in Fig. 2. It will be noted that where panels butt a 3-in. joist is used rather than the 2-in. used elsewhere. The assembly for the drop panel around the column heads, shown in Fig. 3, is somewhat different from anything referred to in Mr. Lockhardt's article, and may be of interest. Instead of placing special post supports under the drop panel itself, extra posts are placed under the girts around the panels and the four joists supporting the drop panels (two on either side of the column) carried in iron hangers hung on the girts. The heavy cleats on the 7/8-in. drop panels are supported on these joists. Small wedges are driven in the bottom of the iron hangers, if necessary, to level the drop panels. Floor panels overlap the drop panels slightly, and a filler of the proper dimensions placed between them.

These are typical examples of the result of careful study of form layout. The same attention has been given to every other operation in connection with the erection, stripping and moving of forms. For instance, instructions state that when floor forms are erected, girts are not to be brought to the floor until posts are in place and the ledgers nailed. Girts are then brought by two-man gangs and placed *on top of the ledgers,* from which position they are easily lifted to their final location.

Standardization naturally works for greatest economy on large contracts, where there are separate gangs for each operation. However, when the underlying principles have once been thoroughly understood and put in practice, by a carpenter foreman or superintendent, these principles can be applied with proportionate economy, regardless of the size of the contract.

Economy of Plain and Reinforced Paving Bases Compared

By J. A. McCabe
Research Engineer, City of Detroit

In considering the question as to the desirability and ultimate economy to be secured by the use of an 8-in. plain concrete, or a reinforced 6-in. concrete foundation for paving in the streets of the city of Detroit, some interesting observations were made by J. A. McCabe, research engineer for the city of Detroit, and some important conclusions drawn. The question was raised in December, 1921, the correct answer involving a practical demonstration by the use of the specifications, methods and materials used in such construction work. Among the most important conclusions included in the report are: Concrete pavements are the most desirable from point of tractive effort, the ratio as determined being about 47 for concrete to 74 for asphalt; a 6-in. pavement properly reinforced will be about 300% stronger than the 6-in. plain concrete, and will cost about the same as 8 in. plain concrete.

The construction of a pavement foundation is far from being a simple piece of laboring work, involving the mixing and pouring of concrete. The mixing of concrete alone is a problem to which much engineering skill and experience may very properly be given. A statement that the failures found in concrete pavements are to be attributed to the engineer, rather than the material, will, no doubt, be resented, but such is the case.

Laboratory tests may, and do, prove delusive if not correctly interpreted. Concrete, a sample of which in 28 days might give a compression test of 3,000 pounds or more, will frequently break up from internal stresses due to moisture when laid in the street. Merely increasing the thickness of concrete will not prevent cracking and failure. Concrete failure is primarily due to absorption of moisture from the earth, which induces internal stresses in under surface of the pavement. The magnitude of the stresses set up depend on quantity of moisture present and capacity of the concrete to absorb the moisture. Mid-summer heat favors the absorption of moisture by the concrete.

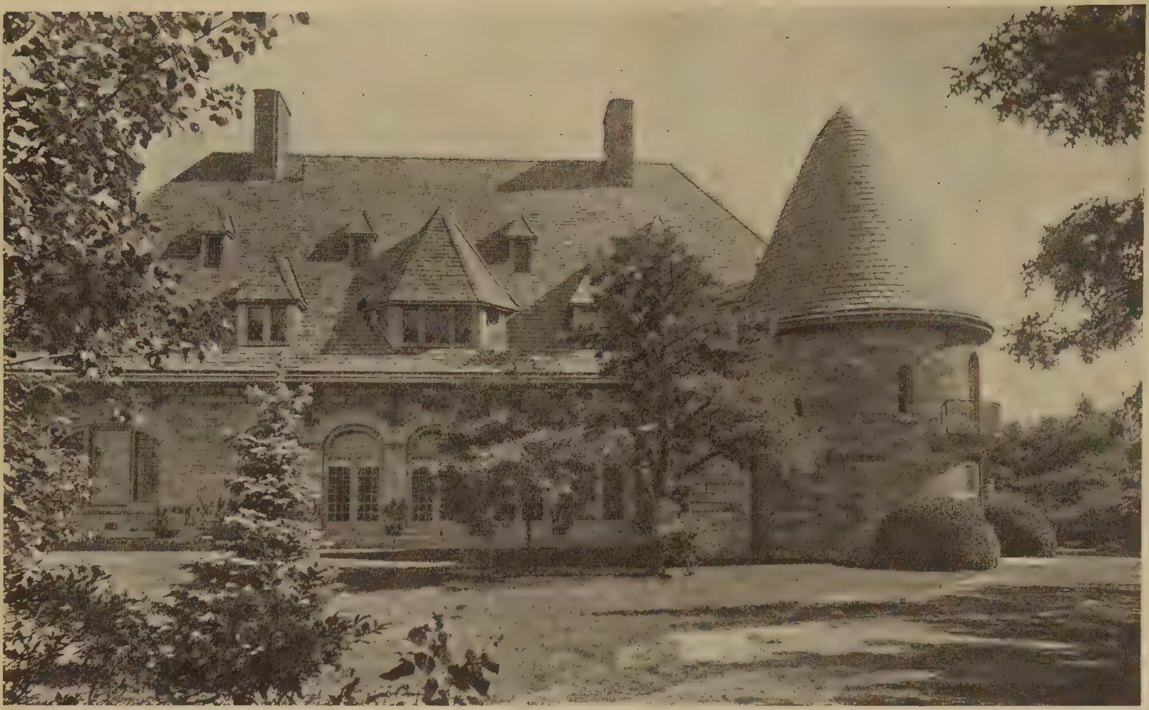
Concrete has a small amount of elasticity. The co-efficient of elasticity is about 1,000 times the compressive strength. For a concrete of 3,000 lbs. compressive strength the co-efficient would be about 3,000,000, which in turn means that a load of 1 lb. per sq. in. in tension or compression would change the length about 1/3,000,000 of the loaded section. It will be seen from this that a sample in tension will usually fail when elongated 1/10,000 of its length, while a concrete in compression may change 1/1,000 of its length.

Internal Stresses in Concrete

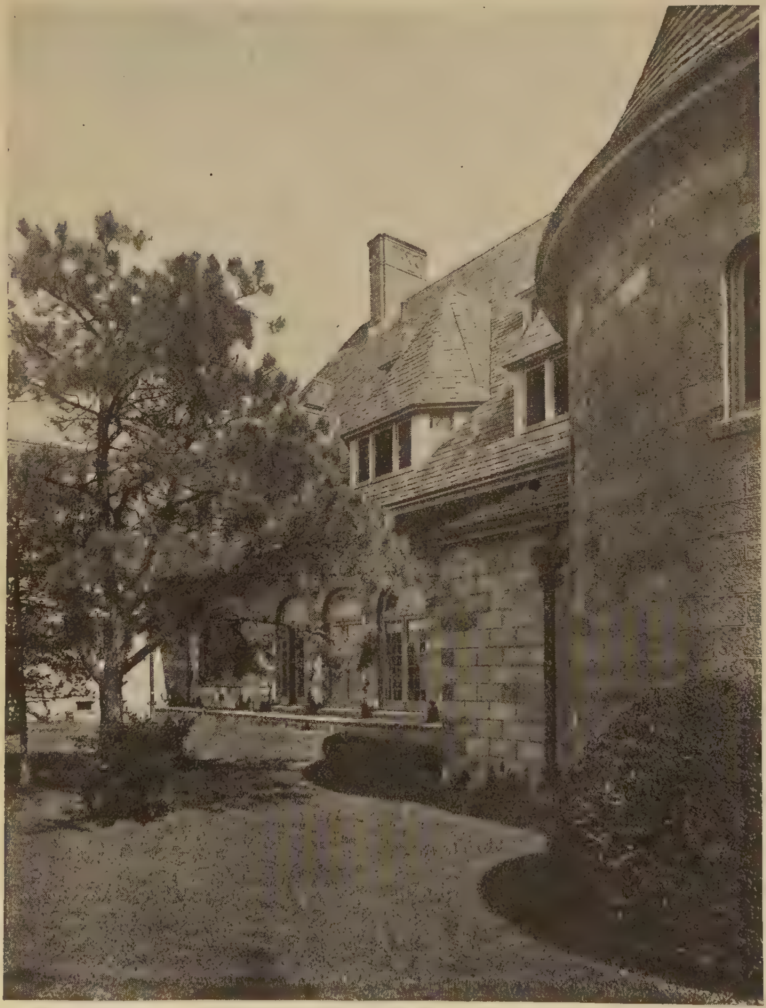
Engineers have been slow to recognize and provide for a measurable and possible control of the internal stresses set up in concrete from moisture and temperature differentials. Practical tests have disclosed that 1% moisture by weight, which is about 2¼% by volume, will strain concrete to its yield point. Concrete uniformly saturated with moisture and elongated therefrom, failure will occur from transverse cracks, if the tensile strength of the cross section of concrete is not great enough to move the mass.

The more common cause of failure in concrete pavements is from longitudinal cracks caused, almost without exception, from moisture absorbed by the lower surface of the concrete. This absorption causes an elongation of the lower surface of the pavement, which tends to cause it to curl up at the outer edges at the curb. This behavior throws a tension load on the upper surface of the concrete, and it cracks from the top down in a longitudinal direction, modified largely by the fortuitous character of the concrete.

Upon examination of a section of sidewalk on Grand River avenue west, a deflection of 7/8 in. was found in a sidewalk slab 60 in. wide. This slab is an arc of a circle, 120 ft. in diameter. This slab was laid in 1905,



FIGS. 1 AND 2—FRONT AND DETAIL TOWER VIEWS OF CONCRETE BLOCK HOUSE FOR HAROLD WEEKES, ISLIP, NEW YORK—GROSVENOR ATTERBURY, ARCHITECT



For the Last 7,000 Years

"This seems to drive home the point, often overlooked by architects, that inartistic results, or the lack of artistic results at all, in dealing with concrete, are merely an architect's admission of his own inability to grasp the inherent possibilities of a new material," writes an architect to CONCRETE, in reference to this work described by Mr. Anderson.

"It is no credit to a man's artistic sense and his creative genius that he can get good results with terra cotta, brick or natural stone, when artists and artisans have been developing a 'technique' in those materials for seven thousand years. But it is a credit to an architect, as an artist and a man, to be able to see and grasp the possibilities of a new material, without first insisting on a thousand generations of experiment, and evolve really beautiful construction with it. And I think we all owe Mr. Atterbury thanks for his enthusiasm, aside from the highly artistic expression he has given it."

A Large Concrete Block House on Long Island

Built for Harold Weekes, Islip, N. Y.; Grosvenor Atterbury, Architect

By W. F. Anderson

Until a comparatively recent date in modern construction, concrete was regarded by all but a few as a purely utilitarian material. In a few instances it had been used for decorative purposes, but even for this it had been dependent upon the ornamental design in which it was cast, rather than upon any beauty inherent in the material itself. The layman home-owner saw in it only a messy substance used for foundations, sidewalks and other utilitarian purposes. The engineer developed its possibilities in construction, and by inserting in it the necessary reinforcing steel, adapted it for use in walls, floors and roofs, thus reducing the cost of fire-resisting structures.

In the engineer's eyes, however, the idea of beauty was subordinated to the needs of practicality, except insofar as beauty might be incidentally attained by good proportioning of lime and mass. Concrete itself still remained merely a useful building material, whose princi-

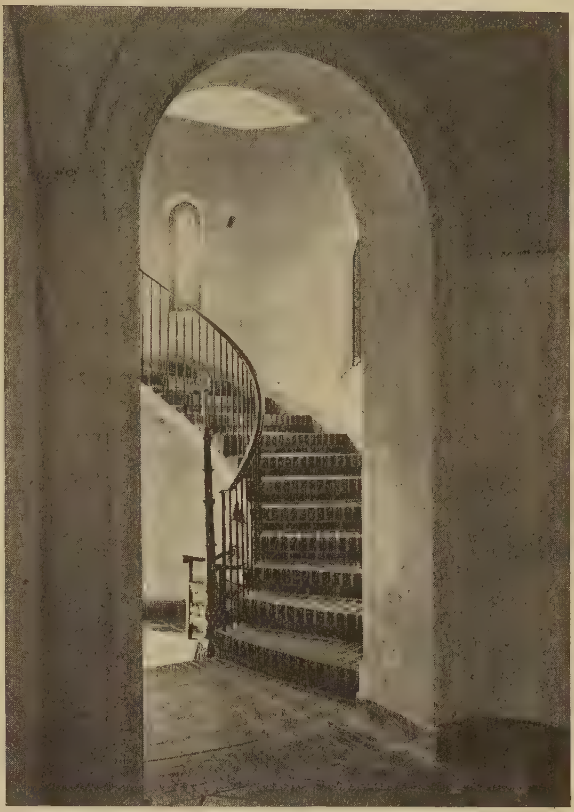
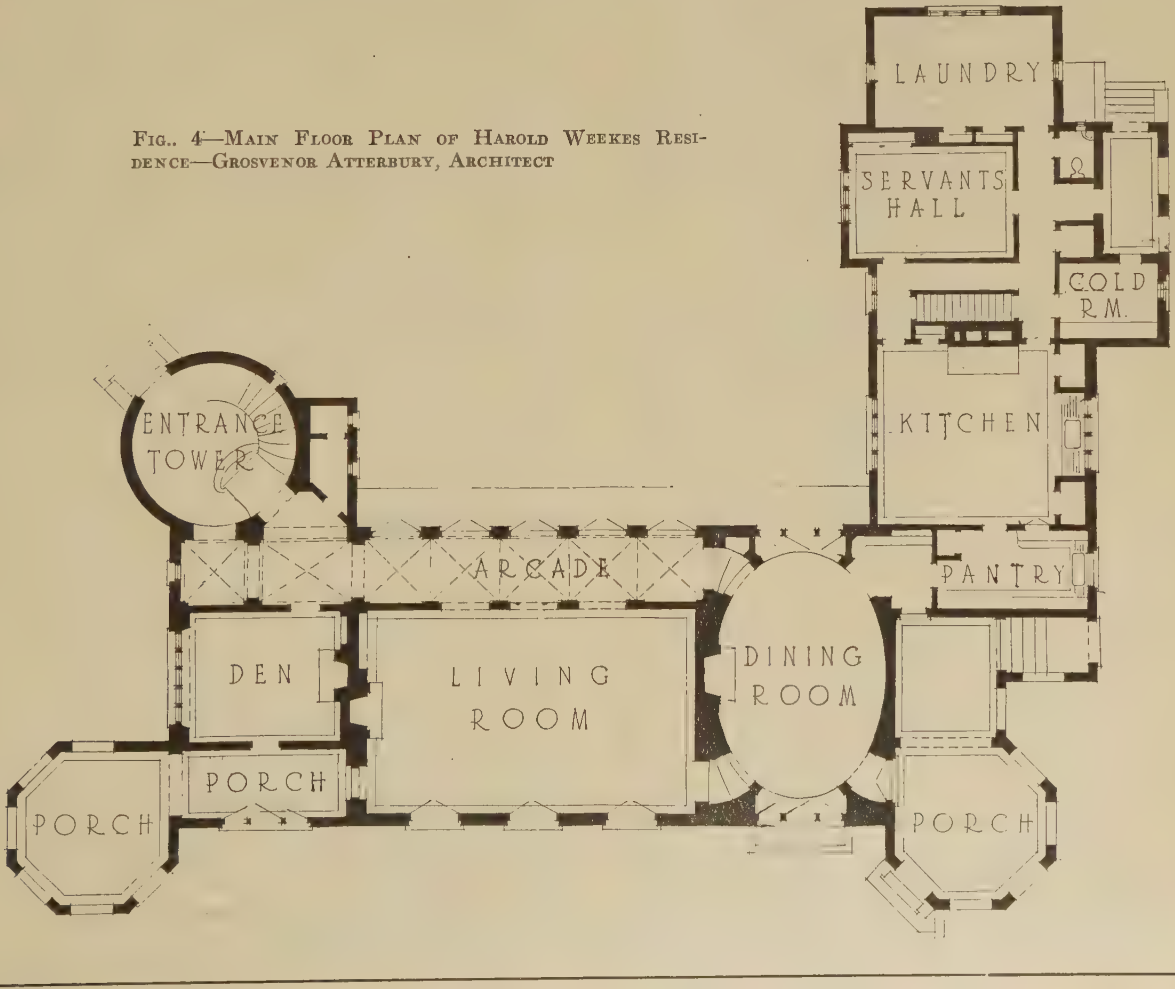
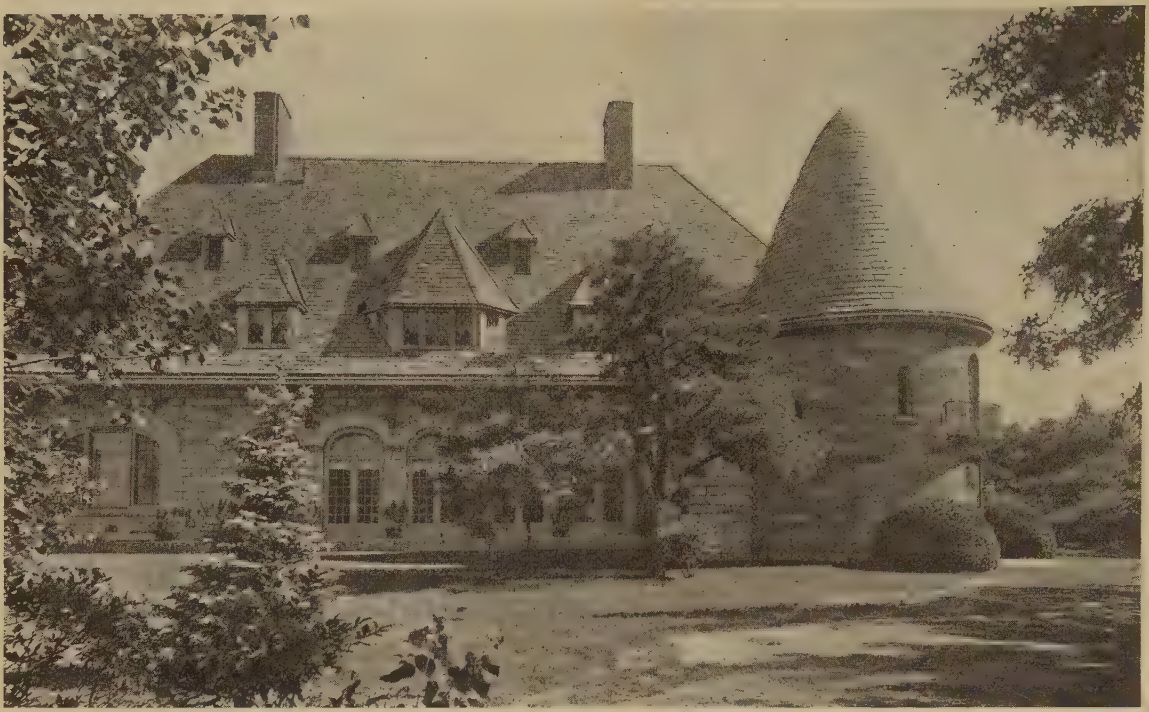
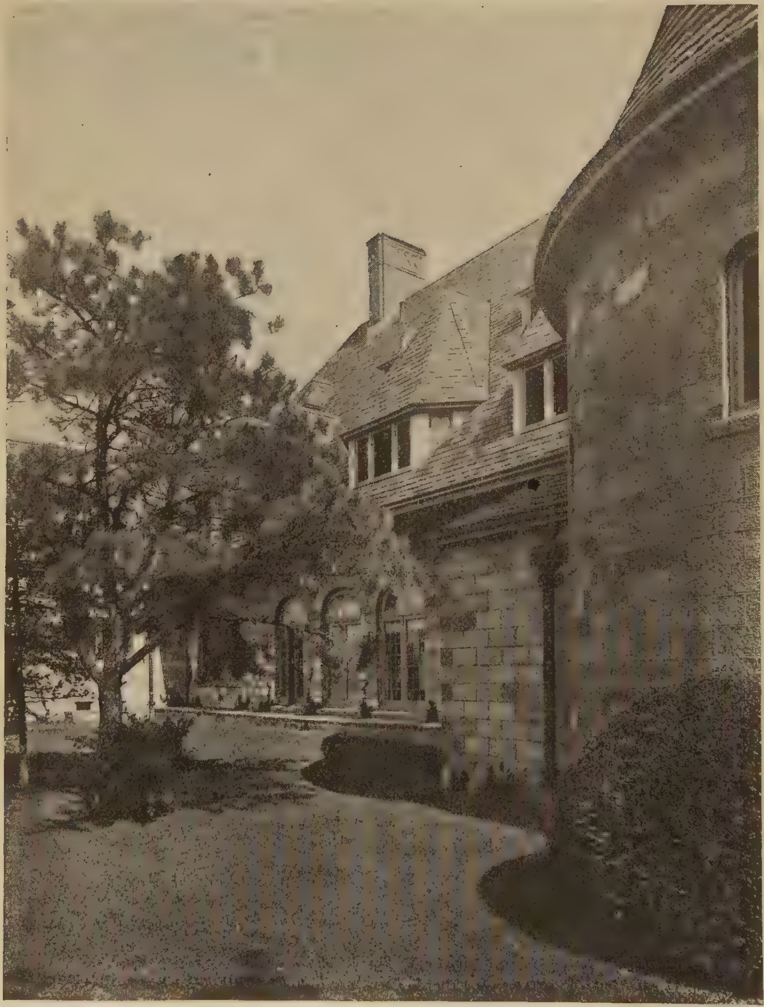


Fig. 3—Entrance Hall, Weekes Residence

Fig.. 4—Main Floor Plan of Harold Weekes Residence—Grosvenor Atterbury, Architect







Figs. 1 and 2—Front and Detail Tower Views of Concrete Block House for Harold Weekes, Islip, New York—Grosvenor Atterbury, Architect

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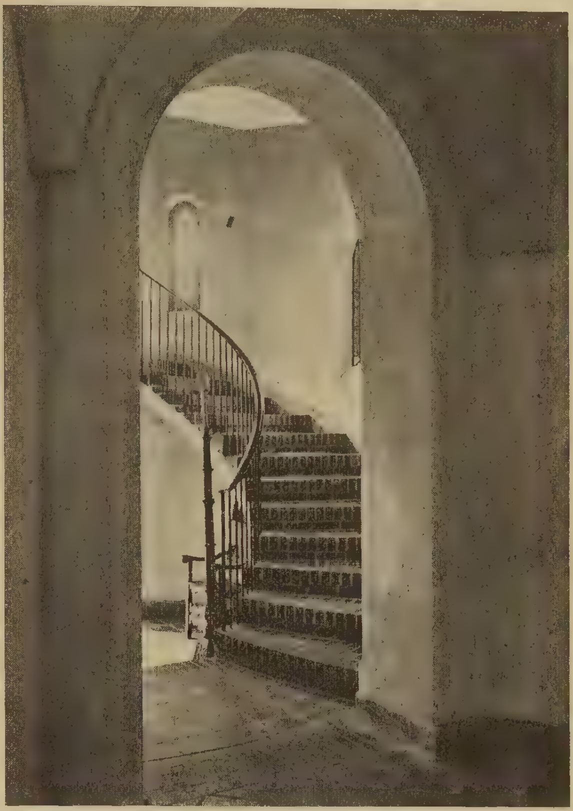


Fig. 3—Entrance Hall, Weekes Residence

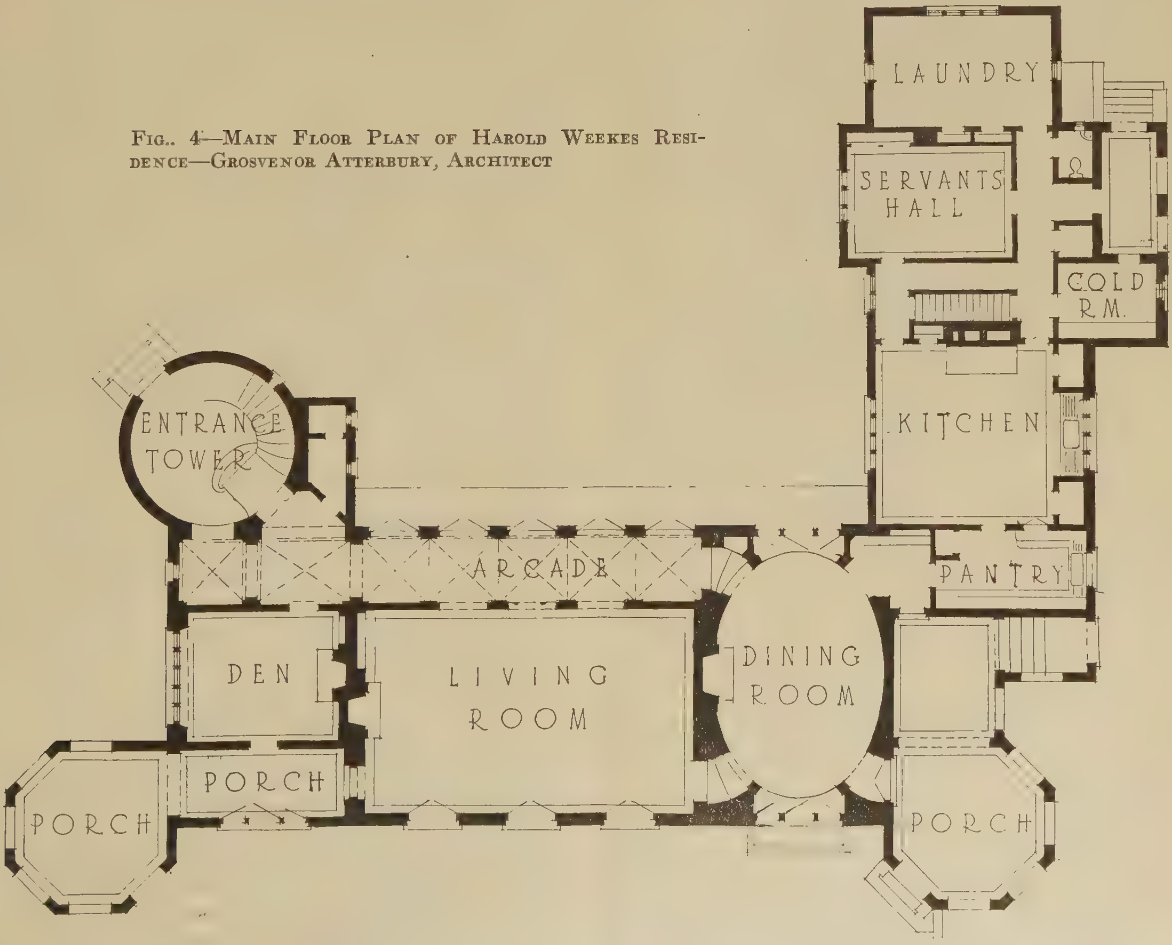


Fig. 4—Main Floor Plan of Harold Weekes Residence—Grosvenor Atterbury, Architect

pal advantage in the scheme of things was its ability to carry loads and withstand strains. Under these circumstances the buildings constructed of concrete were mostly of the plainest types, such as factories, garages and other commercial structures.

At the same time that monolithic concrete was being applied to large industrial buildings, the concrete block was being developed as a structural unit for smaller types of buildings, in which, because of its low cost, it found extensive employment.

Because of the lifeless appearance of a flat cement surface, the earlier manufacturers of concrete block attempted to get a play of light and shadow on the face of the block by the use of molds intended to simulate rock ashlar. The attempt was completely unsuccessful for many reasons—the edges lacked the sharpness and variety of natural stone,, the color was still absolutely uniform, and the expression "concrete block" soon became a synonym for all that was undesirable in building units.

More recently it was found that cast concrete need not always look the same; that various kinds of aggregates might be incorporated in the mix without affecting the structural value of the material; and a highly pleasing effect obtained by suitably treating the face of the blocks to expose the aggregates. When this fact was definitely established the use of concrete in the finer types of residence began to increase.

Grosvenor Atterbury, of New York, was one of the first architects to take up the development of this material, both structurally and for finished work. In some of the buildings first constructed at the high class residential suburb of New York known as Forest Hills Gardens, may be seen cast concrete sections serving the structural purposes for which they were designed while at the same time the exposed surfaces are finished with colored aggregate cast in the block.

It may not be amiss to add that Mr. Atterbury's studies of precast sectional concrete construction and its employment in actual construction have extended over a wide field and for a considerable period of time. Included in the homes erected in this manner under his direction are a large number of both group and single houses at Forest Hills Gardens above referred to, and in other communities.

Under these circumstances it is probably not surprising that, given the opportunity, he should turn toward concrete as the medium for expressing his ideas in a problem involving more of the elements of architectural design than before attempted. The house illustrated in this article is a very good example of the artistic possibilities of rightly handled concrete as used in private residence work.

The illustrations from photographs show the residence of Harold Weekes at Islip, Long Island, N. Y. In this house practically all of the masonry construction is of concrete, in one form or another.

The floor plan (Fig. 4) gives an excellent idea of the size and character of the building. As will be seen, the house is of an irregular "L" shape, 118 ft. 6 in. long by 90 ft. deep. The plan shows the arrangement of rooms on the first floor, which embraces the living rooms, the porches and the service quarters. The bedrooms are on the second floor.

The building is entered by way of the circular entrance tower, in which is located the main staircase, shown in Fig. 3, This staircase, which is supported from the wall only, is of reinforced concrete on which have been placed the brick risers and treads.

The front view of the house, Fig. 1, shows the circular entrance tower and the five large French windows in the arcade, as well as the large three-light elliptical headed window in the dining room. This picture shows the beautiful range of color obtained in the blocks. The variation in color and texteure shows also in the photograph of the west end of the building, Fig. 5.

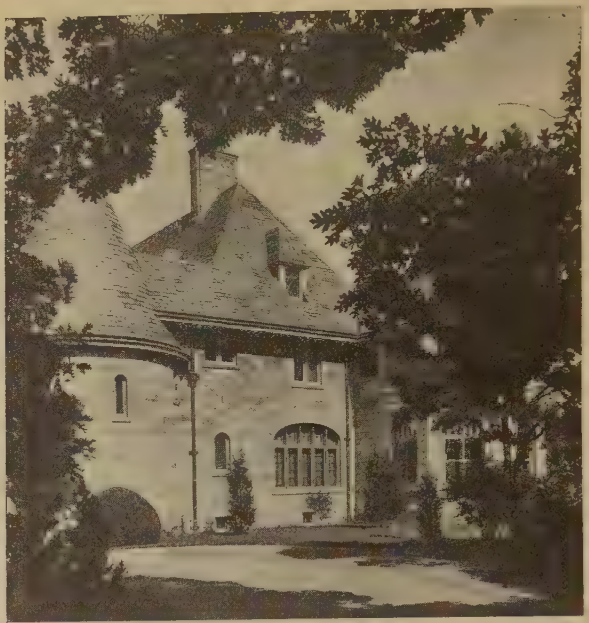


Fig. 5—Excellent Color Variety in Concrete Block Walls

An idea of the very interesting texture imparted to the blocks may be obtained from the close-up photograph of the edge of the circular entrance tower, Fig. 2. This shows the effect of light and shade given by a rough-texture surface, which is distinctive for each block. The monotony of the rock-faced ashlar block is completely avoided.

The cellar and foundation walls are of 1:2½:5 mix, with 10% limeoid added, except where the foundation walls do not enclose a cellar. Because of the presence of ground water, particular pains were taken with the construction of the cellar floor. This was made about 12 in. thick, with heavy reinforcement, with the cement finish laid with an integral waterproofing compound.

The floors of the entrance hall, the arcade and all exterior porches and terraces are of concrete. Where the porch floors occurred over cellar spaces they were waterproofed before the wearing surfaces of tile were laid.

All of the exterior walls above the foundations were built of concrete blocks cast on the site in wood molds made by the carpenter. The usual methods of masonry construction were followed in the erection of the walls.

The blocks were cast of a mix consisting of 1 part of cement to 3 parts sand for the body of the block, and a 1:2 mix for the facing. Two pounds of Medusa compound was added for every 100 lbs. of cement. To obtain a difference in color a small amount of yellow ochre was added to the facing mixture of some of the blocks.

After removing the blocks from the molds they were allowed to stand not more than one day and then brushed with wire brushes, which brought out the aggregate of fine gravel. The differences in color and texture in the various blocks, which are only hinted at in the photograph, are due to three factors:

(a) The presence of yellow ochre in the facing mixture of some of the blocks;

(b) The result of allowing the block to dry out under varying weather conditions—clear, cloudy or foggy days;

(c) The normal variation in the size and color of the screened gravel used in the facing.

[The best effects in brushed out surfaces are not possible with haphazard selections of gravel. Although the author does not explain, undoubtedly a good deal of attention was given the matter of the "screened gravel" mentioned.—Editor.]

The chimneys were constructed of brick with a stucco finish when exposed to view, the color of the stucco being made to match the concrete blocks. The chimney caps were worked in stucco with mouldings to detail formed in place.

The result of the combination of color and texture variation is to give the pleasing effect of a stone house aged by time, so that the building, although new, settles restfully into its surroundings without the unpleasant rawness of appearance so frequently found in new houses.

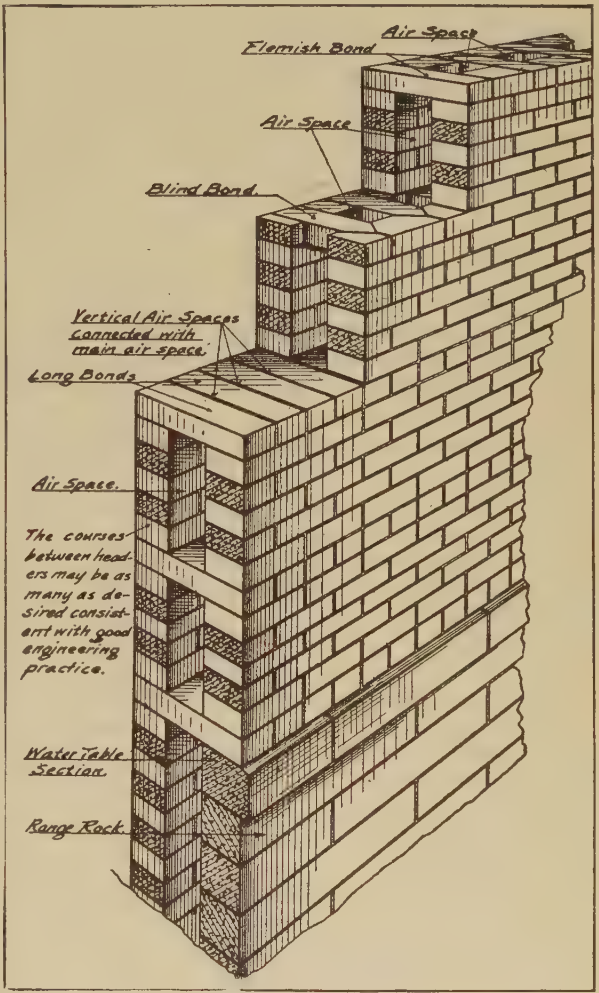
The Development of Shope Brick

The manufacture and use of concrete brick made by the Shope methods have extended, after considerable progress in the Pacific Coast market, to the East. The Shope method, with a waterproof, decorative surface, consists of forming the brick in the usual manner by mixing sand and cement with enough water to make it stand up without slumping after compressing, and tamping it in a mold. Water is then sprinkled over one surface of the brick in sufficient quantity to enter the pores or interstices, a powder of neat cement and mineral coloring matter sprinkled on and worked in with a brush or trowel. The water is thus forced into the voids in the brick, carrying with it the neat cement. Thus a brick is produced which, while having the advantage of a dense face, is not so dense in the body as to interfere with mortar bond. Many beautiful and colorful faces are produced, many of them stippled with color mixtures. The main part of the block remains in a comparatively dry state, so that it can be immediately removed from the mold.

The brick are to a certain extent hand-made. In manufacturing commercially, two rows of brick machines are placed back to back with an elevated runway between them along which the concrete mix for the brick is wheeled from the mixer at one end. The concrete is dumped in bins alongside each machine. The operator places a wooden, metal-lined pallet on the table of the machine, shovels on enough concrete and operates a lever which brings forward a set of knives which divide the material into ten bricks. Another level starts the tamper which compresses the mix. The operator then sprinkles a little water over the surface of the bricks, follows this with a mixture of dry cement and mineral coloring matter, and agitates this material over the face of the bricks with a 12-in. float, thus excluding air bubbles and securing a good bond. The surface is then stippled with a prepared rice-root stipple brush for a rongh texture effect, or troweled to get a smooth surface effect. The pallet is then removed from the machine and stacked in racks which hold nine pallets, then moved to the steam rooms on special rubber-tired lift trucks.

These racks are covered to protect the face of the brick from any possible drip and are cured at a temperature of 65 degrees for six hours, when moist steam is admitted from perforated pipes laid in water-filled trenches along the side of the room. The temperature is gradually raised to 120 degrees and kept there for 20 hours, when the brick are removed to storage.

When properly manufactured, no trouble has been experienced with the face of these brick peeling or deteriorating.


Air Space
Flemish Bond
Air Space
Blind Bond.
Vertical Air Spaces connected with main air space.
Long Bonds
Air Space.
The courses between headers may be as many as desired consistent with good engineering practice.
Water Table Section
Range Rock.

Shope Hollow Wall Construction

Many large buildings have been constructed of Shope brick, including the Montgomery-Ward building, Portland, Ore., in which 1,500,000 face and common brick were used and a $300,000 labor temple, one of the finest in the country. Shope brick were given the preference over the clay product in this job, despite a difference in price of $8.25 per thousand.

The illustration shows the Shope hollow wall. The Shope brick machine can be adjusted to turn out various sizes of brick and by manufacturing a quantity of 12-in. headers, a 12-in. wall with a 4-in. air space can be built. Blind headers can also be molded if desired, and used as shown in the drawing.

Inspection of Portland Cement[1]

By J. R. Dwyer and Roy N. Young

I. Introduction

Efficient inspection of cement is essential if confidence is to be placed in the results of tests of the samples, and if certification is to be made by the inspecting agency as to the quantity and condition of the shipment.

Much has been written about the inspection and testing of portland cement, but it appears that there is need for a paper dealing more fully with the inspection. This has been emphasized very frequently by inquiries from purchasing offices and the questions raised by inspectors. Even an inspector who is familiar with the various mill processes involved and the routine of inspection, is often called upon to make a decision which has no precedent in his experience. It is not intended that this paper shall be so far reaching as to be of assistance in all such cases, but during long experience in this work at widely scattered points, certain procedures of inspection as herein outlined have been demonstrated as being the most effective in avoiding complications and in holding the confidence and respect of all parties concerned.

It should be distinctly understood that this is not intended to convey the impression that the personnel of the mills should be held under suspicion, nor in any way to be a criticism of certain practices employed in the portland cement industry. On the other hand, it is hoped that the information contained herein will be of assistance in conducting true inspection of cement.

II. Cooperation Between Mill and Inspector

The inspector must remember that he is not detailed to obtain proof of faulty material or misrepresentation on the part of the manufacturer, but that it is his duty to secure personally the information which makes possible, without doubt or assumption, his definite and positive certification to all the points involved in his inspection. To perform this work properly, he must exercise requisite care and take all necessary precautions. When his work is well done he will have avoided occasions for doubt in his own mind, and will not lay himself open to just criticism. The possession of the necessary information is of value as protection to the mill as well as the purchaser, and the inspector should feel no hesitancy in frankly requesting and firmly insisting upon such information.

Not all mill employees regard an inspector with equal good will. Tact and good judgment must be employed to avoid friction. Courtesy and consideration on the part of the inspector are especially in order. In addition, it is important that he learn with whom he should take up the various matters, especially any serious disputes. He should have in his mind a clearly defined idea as to the extent of his work and not exceed his rightful authority.

Both the operation of the mill and the shipping of the product require considerable planning by the manufacturers, and their interests should be well considered. Arrangements should be made to meet their convenience as far as circumstances permit, and appointments should be kept promptly.

In matters of urgent shipments, requests for special information, adjusting difficulties and even the inspector's personal welfare, the good will and cooperation of the mill employees are desirable. Therefore, with all due regard for proper and efficient inspection, the inspector should especially endeavor to avoid unnecessary friction arising from misunderstandings and disagreements.

On the other hand, especially when a mill has definitely contracted to submit certain orders for inspection, the inspector is to expect prompt fulfillment of the agreements made with the purchaser. Bins should be furnished as contracted for, and in time for the specified tests to be completed before the dates set for shipments. Government specifications allow at least 10 days for completion of the 7-day tests and 31 days for the 28-day tests, reckoned from the date of the sampling. The testing laboratory should arrange with the mill for the furnishing of the proper facilities and assistance.

Many orders are handled under special arrangements for shipping, inspection and making tests at the mill laboratories, and such special details are left for proper settlement in the particular cases concerned.

The inspector should report immediately to the inspecting office any difficulty or cause for complaint, in order to have such matter promptly adjusted and recorded.

Unless authorized, he should not make known to the mill any of the details of tests or investigations.

It is the best policy for the inspector not to enter into any personal agreements with the manufacturer without first giving full details to the testing laboratory.

To prevent the necessity of reconsignments, loss of tested cement, errors in reports, and misunderstandings, it is essential that the mill give details sufficient to identify shipments if the inspector relies on the cement company for shipping information. In some cases, special arrangements provide for the transmission of shipping instructions through the inspector.

III. Definition and Specifications

Definition—It is fitting that the discussion of portland cement inspection should contain such definition of that material as may have a bearing on the inspector's work. The following definition, which has been taken from the U. S. Government's Specifications for Portland Cement,[2] is also used by the majority of the technical societies of this country, and closely resembles the definitions of most of the foreign countries:

> Portland cement is the product obtained by finely pulverizing the clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum.

The inspector's attention is called to that part of the definition referring to the process of manufacture and handling subsequent to the burning of the clinker, since it is after that operation that prohibited additions or adulterations may be made. If the inspector has any reason to believe that the cement has been adulterated he should notify the laboratory, giving details and if possible take a sample of the questionable material as it is being added.

Inspection as ordinarily understood, and as herein referred to, is concerned only with the process after calcination, and any prior inspection would be done only under special arrangements.

Specifications—There should be a clear understanding as to the specifications with which the cement is to comply, in order that there may be some basis upon which to adjust any difficulties or contentions.

IV. Kiln to Finished Product

Intervening Steps—The steps intervening between the kiln and the shipping of the cement may be some or all of the following: Cooling, clinker storage, preliminary grinding, addition of gypsum, finish grinding, storage and packing. No attempt will be made to describe these operations, as the machinery and layouts vary widely among the different mills. However, the inspector should know something of the general types of grinding machinery and conveying systems and be able to use the proper terms in referring to them. When beginning an inspection, the inspector should make himself familiar with the layout of that part of the mill dealing with the processes between the kiln and the disposition of the cement by storage or packing.

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[1] Published by permission of the Director of the Bureau of Standards.

[2] Bureau of Standards Circular 33, Third Edition.

V. CEMENT STORAGE

Bins—Bins for the storage of cement are built of various materials, and in different forms. The chief points of interest to an inspector are the facilities for sampling and sealing, and the possibility of leakage or overflow of cement from adjoining bins.

Storehouse Outline—A brief outline sketch, showing the position of bins and packing machines and the paths of the conveyors between them will often be of value to the inspecting office, as when instructing new inspectors or in deciding which of a number of bins can best be emptied or released to the company.

Cleaning Bins—It is desirable that all cement be removed from a bin before it is filled for test. Any cement adhering to the bin wall or floor in a cake, which is sufficiently firm to not loosen or mix with the inspected cement as it is drawn from the bin, may be allowed to remain. Also there may be times when it is impossible to remove all of the loose cement because of shortage of labor and poor facilities for emptying the bin. If such is the case, the residue must be sampled as outlined in Section VI.

Sealing Bins—Before sampling all old seals should be removed and new seals placed on the outlets. The sampling is discussed in Section VI. When the bin is full, all top inlets or chutes should be sealed and the condition of cement on the top surface of the bin should be noted.

When shipments are to be made, the seals on bin outlets should be recorded before breaking, and the new seals should be placed on outlets as soon as packing is completed. The construction of some bins does not permit the sealing of the outlet. If such is the case a note should be made of the appearance of the surface of the cement. If later observations indicate that the cement in the bin is not that which was sampled, because of replacement of the cement, or overflow from an adjoining bin, the bin should be rejected or resampled, as the inspection office sees fit. For proper identification it is essential that the construction of bins be such that outlets and inlets can be sealed and that no addition can be made without breaking the seals.

Breaking Seals—It will be found advisable in practically all cases for the inspector personally to break seals, even on empty bins. In any case, unauthorized persons should never tamper with seals and the mill should be considered responsible for broken or missing seals, unless they have been removed by authorization of the inspector or the testing laboratory. This will prevent much chance for misunderstanding on the part of the mill employees, who may otherwise become accustomed to removing such seals which they deem no longer necessary.

Length of Storage—The length of time during which a stock will be maintained under seal will be governed by instructions from the testing laboratory.

Bin Capacity—The capacity of a bin is generally known by the mill authorities, but it sometimes becomes necessary to estimate this. In either case it is well that the inspection office fix the percentage of excess which may be removed from the bin as tested cement. When this limit is reached, the bin should be considered empty.

Empty Bins—When a bin becomes empty, the inspection office should be notified and the inspector should remove all seals.

VI. SAMPLING

General—Various methods and devices are used in securing samples. The selection of the particular method and device is controlled by the general layout of the mill, the construction of the bins, and other circumstances, and is a matter for the decision of the inspecting laboratory. However, the purpose is to obtain samples truly representative of the material under inspection, and the instructions of the inspection laboratory should specify the manner of sampling and the quantity of cement to be represented by a single sample. The various methods are briefly outlined herein, with such remarks as have a bearing on their efficient performance. It is the duty of the inspector to be present and supervise sampling if the assistance of others is necessary. Under no circumstances should he allow samples to be taken in his absence.

First we will consider the sampling of cement which is to be stored at the mill awaiting the results of tests. While in some instances this material will be packed and set aside until completion of the tests, the general custom is to store such cement in bins.

Conveyor Sampling—The preferable manner of sampling is to take the samples from the material as it is flowing into the bin. The material may be coming from one or more other bins, or directly from the finishing mill. For such sampling, it is essential that the inspector obtain a definite knowledge of the general layout of the conveying system, determine from where the cement is coming, if the source must be known, as in resampling cement for check soundness tests, and keep watch on other conveyors to make sure that no cement except that which should be sampled in entering the bin.

If the bin contains a residue of loose cement (see Section V) samples should be taken from it before adding the new cement. In no case should a bin be accepted for test if it contains a loose residue from which it is impossible to obtain representative samples. It should be understood that the failure of samples from such residue will cause a rejection of the entire bin.

Sampling may be done either by the so-called "grab" method, or by a continuous operation. The instructions of the inspecting laboratory should govern. The whole of a grab sample is taken at one time and tested as an individual sample.

The intervals at which samples are to be taken must be determined by carefully estimating the time required to convey the quantity represented by one sample. The mill officials will be in a position to impart this information, and under no condition should the sampling interval be varied from the period estimated by them. If the proper number of samples are not obtained, due to insufficient information as to the rate of flow, the inspection laboratory should be advised of the circumstances. Serious shortage in the desired number of samples should be cause for the rejection of the cement. The sample preferably should be taken at the point of discharge into the bin. The construction of bins and the layout of conveyors, however, may require or permit taking samples at other points in the conveying system.

Automatic sampling devices are sometimes used. These are of various types, and it is suggested that before any are used the matter be discussed with the laboratory, with details regarding the facilities for protection against being tampered with during operation. The entire amount of cement collected by the device during the desired interval should be thoroughly mixed before taking the laboratory sample. The remaining cement should be disposed of.

Tube Sampling—Occasionally inspectors are authorized to sample bins of cement by the use of sampling tubes. There are a number of styles of sampling tubes, but none have proven to be entirely satisfactory. Samples should be taken from the sample holes in sides of bin, and also from the top of the cement. The tube used in sampling the top of the bin should be of sufficient length to penetrate the full depth of the cement in the bin. A small sketch or note should be made of the location from which the various samples are taken. Holes in the sides of the bin for the insertion of the sampling tube should be so arranged as to furnish one sample for each quantity of cement used as the sampling unit. End or corner bins are usually preferable, because of additional or better distributed sampling holes. The tube should be so manipulated as to obtain a core along the entire length.

Vertical Sampling Tubes—Use has been made in some cases of vertical tubes, with side openings, set in place before the filling of the bin. These tubes are withdrawn after filling the bin and the cement within the tube is considered to represent the various layers of cement according to their relative locations, the samples being taken from sections of the included core. When this tube is withdrawn, it is sometimes found that the top portion is not filled, indicating that all of the cement in the tube has settled or that some portion has not been well filled. Moreover, when a bin is large or filled from more than one point, there is no assurance that the samples are representative of all the cement within the bin unless a number of tubes are used.

Sampling from Discharge—It is the custom of some laboratories to release a portion of the cement from the bin and take samples at short intervals as it flows from the discharge opening. An indicator, such as a wood or cork ball, is often placed on the surface of the cement above the opening, and the cement is allowed to flow until the indicator appears at the discharge. Some laboratories authorize the use of this method, either alone or in connection with tube sampling, but generally it is not commendable. It is open to the same objections as the vertical tube placed in the bin prior to filling. (See preceding paragraph.) If the bin is large, or filled from more than one point, the samples may not be representative, for it must be remembered that the crater formed above an outlet is of relatively small diameter, with almost perpendicular sides, gradually forming into a cone at the top, and the indicator will appear at the discharge after a relatively small portion of the cement has been disturbed. Tests have shown that a hole extending the full depth of the bin is first formed, and then the material from the top surface falls into this hole, forming the cone-shaped crater. It can readily be seen that this method would not obtain samples representative of the entire contents of a large bin, especially if it were filled from more than one point.

Relative Merits of Methods—Though the inspector should be governed by the instructions of his laboratory, it may be well for him to know that tests have been made of the various methods of sampling bins. A discussion of some of these tests will be found in a report of Sub-Committee VII. of Committee C-1 of the American Society for Testing Materials (Data considered by Committee C-1 of the A. S. T. M. in Preparing the Standard Specifications and Tests for Portland Cement). The report deals with sampling in particular and gives considerable data obtained by sampling a bin filled with alternate layers of sound and unsound cement.

Car Sampling—If samples are to be taken at the time of shipment, they are usually secured from the bags directly after leaving the packing machines, or after they have been placed in the car. Since a very valuable part of inspection consists of the checking of quantities and the loading of cars, it is desirable that the inspection be performed during the packing. At any rate, when sampling a previously packed car, attention should be paid to the general condition of the car and its contents, as well as noting the number of packages.

Samples are secured by inserting a small sampling tube through the bag valve or by opening the mouth of the bag. Samples may be individual or composite, according to the inspector's instructions.

Considerable cement is now being shipped in bulk and, if it is to be sampled at the time of shipment, it should be done preferably while the car is being loaded. Samples may be obtained from the loaded car with a suitable sampling tube.

Miscellaneous Sampling—If previously packed cement or cement in storage at warehouses or building sites is to be sampled, the same general instructions hold, with the additional precaution that the arrangement of the various lots be definitely determined, their location be well described in the inspector's notes or sketch, and that the sampled bags be identified by a tag or mark to permit of their later selection if needed. Also, especially when cement has been in storage for a considerable time, its general condition and the storage facilities should be noted. It is advisable to record any available data relating to the identity of the shipments from which the stock is reported to have come.

Treatment of Samples—All samples should be properly identified by means of sample slips placed within the containers. These slips should be filled out as each sample is obtained. Bin samples should be numbered in the consecutive order in which they are taken.

It is preferable to ship samples in air-tight containers. In case heavy cloth sample bags are used, they in turn should be placed in larger sacks. Each large bag should be well secured, fastened with a seal which passes through and around the top of the bag, and be well tagged for shipment. Delay and damage to samples in transit are to be guarded against, and it is well to place two tags on a bag. Express agents often paste their way bills on tags and, if only one tag is available, desirable information may be obscured.

If a declaration of value is necessary when shipping samples, it should be remembered that samples are specially taken and prepared and are of more value to the laboratory than ordinary commercial cement.

After samples are taken, they should not be left unguarded. If it becomes necessary to interrupt the work or leave the samples or entrust them to others, it is requisite that such lots be sealed. Unless he identifies and seals these samples, the inspector is neglecting to provide that assurance of continuous identification which is necessary if inspection is to mean what its name implies.

(To be concluded in September issue)

FIG. 1—FIRST OF GROUP OF CONCRETE BLOCK HOUSES PROVIDING 26 DWELLINGS, IN BROOKLYN

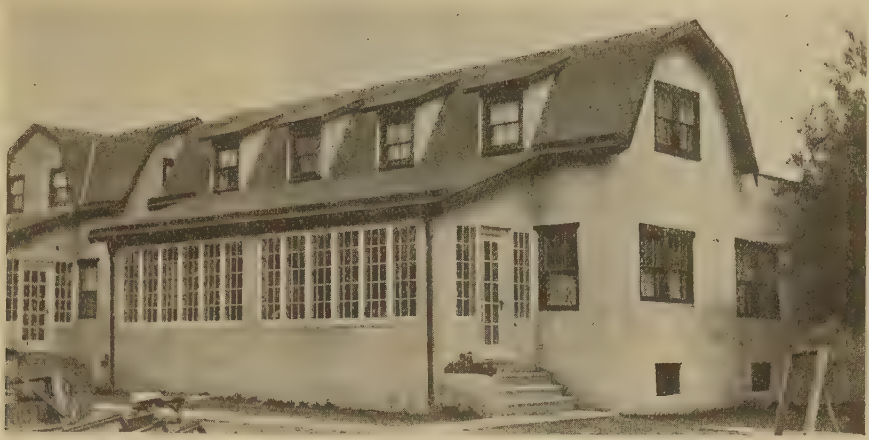
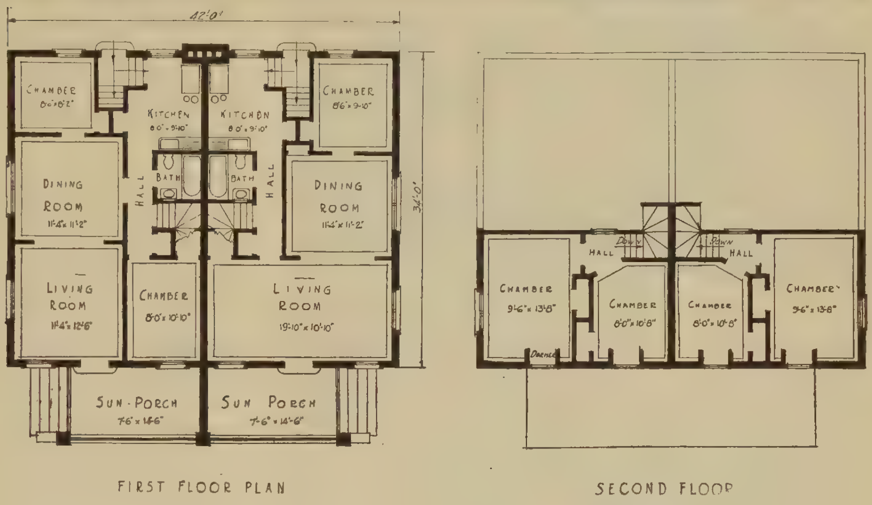


FIG. 2—TYPICAL FLOOR PLAN, VANDERPOOL CONCRETE BLOCK HOUSES



Group of 26 Block Houses in Brooklyn

The advocates of concrete block construction for houses have always emphasized several valuable talking points, in which concrete was superior to the other materials, which are all worth considerable thought on the part of any man who intends to build for himself a home, but they become worth considerably more thought to the man who is about to build himself 26 homes instead of one. Let's see how it works out in his case.

F. C. Vanderpool, of Brooklin, had a chance to get an especially attractive piece of real estate, near one of Brooklyn's subway lines, at a bargain price. Mr. Vanderpool, who is an extensive realty operator in Brooklyn, had his choice of building a group of houses on this plot and selling them, or, because of its desirable proximity to the beaches, retain title to the houses himself and rent them to the tenants who could always be found for this locality. Mr. Vanderpool chose the latter alternative, and is now erecting the 26 semi-detached houses mentioned above.

The factor of low initial cost usually associated with properly handled concrete block construction was therefore a big item, as he would have to carry the cost of all these buildings himself. In addition, with the thought in mind that a tenant is never as careful of some one else's house as he would be of his own, the depreciation and upkeep on 26 houses, instead of one, became quite formidable. Mr. Vanderpool says he would not have considered the proposition without using permanent construction.

Ease of heating is an advantage claimed for the concrete house. These houses are located within walking distance of the Atlantic Ocean, and it is necessary to be able to assure tenants that their coal bills will not be excessive. Here is where Mr. Vanderpool has done something calculated to make prospective home-owners who are considering concrete block sit up and take notice. Mr. Vanderpool, after his experience with these houses last winter, tells prospective tenants that he is willing to write into the lease an agreement to pay for all coal in excess of five tons required to heat these six and seven-room houses per winter. The magnitude of that offer can best be appreciated by those who have had to pay from $13 to $17 a ton for their coal last winter, and who were thankful that they had coal to buy for only one house. If Mr. Vanderpool was not sure of the weather resisting qualities of his houses he would be likely to have coal to buy for 26 of them.

The floor plans show the size and distribution of the grams, freight and drayage inward, machinery repairs, detached type, one house containing 6 rooms and the other 7, the living room, dining room, kitchen and one or two bedrooms in addition to the bath, being on the first floor; there are two bedrooms upstairs in each house. It will be noted from the photographs that Mr. Vanderpool has succeeded in getting a very interesting variation in the character of the houses by an extremely ingenious treatment of the dormer windows in the second floor. The first house of the group shown in Fig. 1 has four

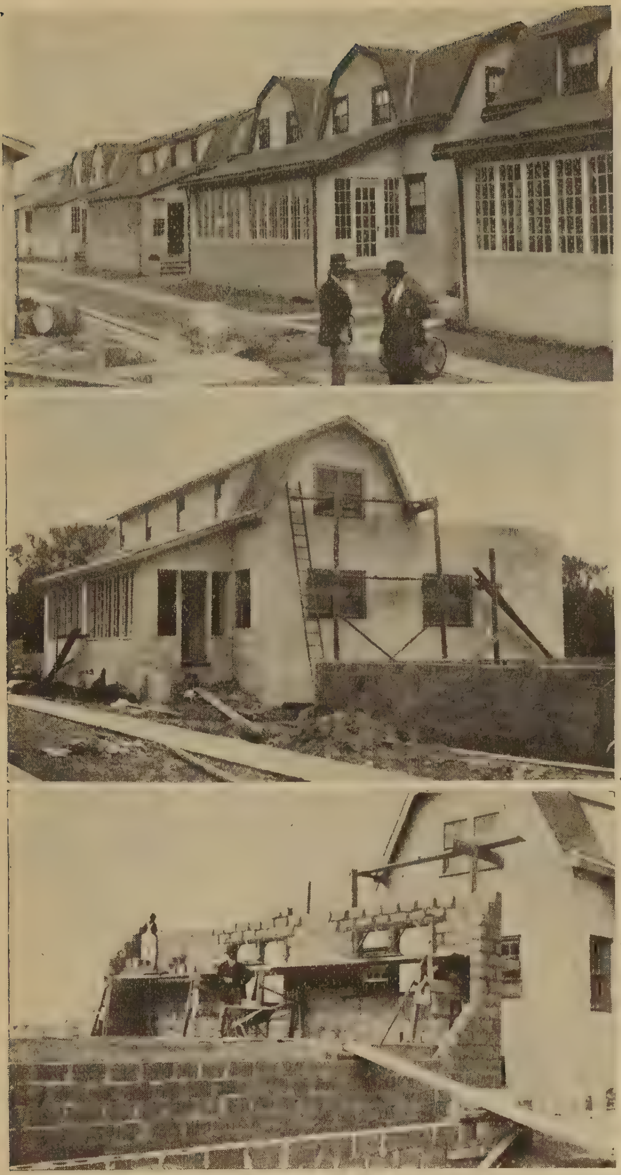


Fig. 3—Row of Houses Showing Different Dormer Treatments, to Get Variety into Skyline

Figs. 4-15—Construction Views, Vanderpool Concrete Block and Stucco Houses

individual dormer windows in the gambrel roof. Fig. 3 is a view looking down the uncompleted street between two rows of these houses. This picture shows how the second house was modified by grouping two windows at each end of the building in a gable. The next house has two large dormers, each of which contains two windows and after another house with two gables in front he has placed a house in which all four of the second story windows have been grouped in one large dormer. This arrangement is being used for the second house on the opposite side of the street, which is shown in a close-up in Fig. 4. Fig. 5 shows the masons at work on the scaffold, laying up the first story walls of the first house on the opposite side of the street.

Exceptional care is taken to get a good quality of workmanship in laying up the block. The joists on both the inside and the outside of the wall are thoroughly pointed up with a portland cement mortar, after the block have been laid. Although it is contrary to recommended practice, Mr. Vanderpool has plastered directly on the inside faces of these block walls, and has had no trouble with condensation during the cold weather of last winter. The houses are stuccoed on the outside and a very attractive finish obtained by embedding in the stucco before it has set up black and white marble chips on some of the houses and a pink marble on the others.

The interior partitions and ceilings are covered with Sheetrock gypsum wall board, the sidewalls being papered and the ceilings kalsomined. The houses have steam heat and electric light, with a modern bathroom with skylight overhead. A good grade of trim and fixtures have been used throughout these buildings, and as a result a large number of desirable tenants have been attracted to this development, so that Mr. Vanderpool has a waiting list for the houses as fast as they are completed. This may be because the flat roof in the rear, with its three-foot parapet, forms an ideal open porch away from the heat and dust of the street during the summer, which is particularly attractive to the city dweller.

At any rate, the proof of the pudding is in the eating. Not only is Mr. Vanderpool living in one of these houses himself, but he has bought 5½ acres of land immediately adjoining this plot on the south, and will develop this plot with houses of the same character as soon as the present operation has been brought to a close.

Built on land which is perilously near sea level, the city of Galveston has suffered considerably in the past by flooding in times of storm, and several years ago, when the sea defenses were improved, arrangements were made for raising the level of the greater part of the site. Further sea wall construction in concrete recently has been carried out under the supervision of the War Department, and one of the most interesting features of the operations is represented by the employment of portable steel forms moved by a traveling crane.

The wall itself is 16 ft. high, with a vertical back, while the face is a compound curve joining the toe to a vertical portion 6 in. above the foundation. The wall and base are supported on four rows of foundation piles 4 ft. apart, each pile sustaining a dead load of 12½ tons, with a triple line of lap sheet piling under the front row, all the piles being of green pine. Reinforcing bars 1½ in. square are embedded in the concrete 6 in. from the face of the wall, which is protected in front by an apron of stones, 6 ft. thick by 27 ft. wide.

The construction plant was designed so that every part of the work could be carried out without hindering operations in any other part. Excavation for the foundations was done by a locomotive crane operating a grab of the orange-peel type. Two pile-driving plants were provided, one for foundation piles and the other for the sheet piling. The steel forms were moved from point to point by a traveling crane with two sets of three wheels, running on tracks at the front and back of the wall, and the frame was constructed so as to clear the wall when built up to its full height. Several storms occurred during the execution of the work, but without suggesting the desirability of a change in the design of the wall or in the construction methods adopted.

The Semi-Annual Index of CONCRETE, Vol. 20, January to June, 1922, is ready and will be sent, without charge, to all subscribers who ask for it.

Our Foreign Contemporaries

A Review by E. Lee Heidenreich

Progress in Building Concrete Ships and Docks

In lieu of his annual paper before the *Deutschen Beton-Vereines,* Dr. Eng. Teubert, of Minden, West, has submitted an outline in *Tonindustrie-Zeitung* of the present status and progress made in concrete shipbuilding and construction of floating docks.

Owing to the new Mewag-Teubert method of construction, whereby the wooden forms and the expensive launching are omitted, the Mindener reinforced concrete shipbuilding plant at Minden has succeeded in producing river craft for the inland traffic, which in all points has proved itself equal to steel vessels, and has met all the objections of the opponents to concrete ships with overwhelming success.

The time of construction of a 1,000-ton concrete ship is only 4 to 6 weeks. The two boats of 850 tons capacity finished at Minden for towing services were 220 ft. long, 27 ft. 6 in. beam, and 7 ft. 4 in. side, and only 7% less dead weight capacity than steel vessels of the same size.

The draft is 13¼ in. fully equipped, or barely ¼ in. more than the lightest ship of same size built under the German-Lloyd rules. This is fully overcome by the decreased friction owing to the greater smoothness of the concrete surface. According to public tests, the towing pull is only 1.1 lbs. per ton, while the sharp Rhine tugs show a pull of 1.32 lbs. and the regular river boats require 2 lbs., or twice as much as a concrete tug.

The cost of a steel vessel is practically twice that of a concrete boat, since the double wooden form has been abandoned. This difference amounts for floating dry docks to between 40% and 80% in favor of concrete boats.

Maintenance and repairs have proved themselves entirely in favor of concrete construction.

German Colorings for Concrete

The production of satisfactory colored concrete products and the proper coloring of concrete surfaces depends on the use of mineral colors. *Zement,* a German periodical devoted to the uses of cement, gives the following selection of pigments to produce various shades: The best pigment for reds is produced from red bole, a friable clay, containing iron oxide, whose tint has been developed by calcining and grinding. Other iron oxides are also satisfactory. This color does not appear to be directly related to the chemical composition of the material, but rather to the size and density of the particles. Another good color is obtained as a by-product of the manufacture of sulphuric acid from iron pyrites. This, however, should be free from any acid.

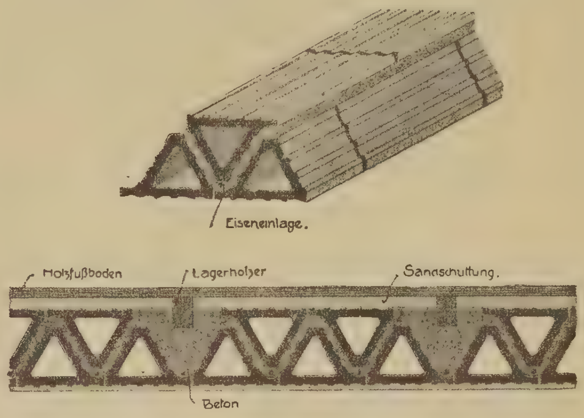
Ochre gives a light shade of yellow and umber a dark shade. Both of these materials affect the strength of the concrete. Zinc yellow (zinc chromate) is satisfactory, but is generally too expensive. Manganese dioxide produces the best black, but lampblack is less expensive. Ground coke is also used, but, like the others, must be very finely ground.

Greens and blues are made from ultramarine with some other pigment, such as chromium oxide, lime green or yellow ochre to give the required shade. Contrary to the effect of all other colors, ultramarine increases the strength of the concrete, on account of the colloidal silica and aluminum present. The best green pigment is chromium oxide, which can be prepared with difficulty from potassium bichromate and sulphur, or can be bought prepared. Lime green is a magnesium alumino silicate containing iron. This pigment is liable to fade.

The Berra Hollow Tile Floor Construction

The illustration shows a perspective view of the Berra hollow tile and also a cross section of a hollow tile floor with reinforced concrete arrangement and wood finish.

Tonindustri-zeitung tells us that these tiles are 6½ in. wide, 4¾ in. high and 10 in. long, with ¾ in. thick walls. The tiles are made in parallelograms, so as to make two tiles at a time, with the walls so arranged as to come apart during the curing process, or during transportation.



Berra Hollow Tile

These floors are used for spans of 15 ft. or more, according to the amount of reinforcing used, and combining strength with insulation and being rather noise-proof, they are well worth taking into consideration.

Curing of Reinforced Concrete Products Under Steam Pressure

(Dr. R. Saliger, Vienna, in *Beton U. Eisen*)

Ernst Maier, of Vienna, has obtained patents on the use of high pressure steam in curing concrete products.

Under a steam pressure of nine atmospheres, six hours of curing gave a greater strength to a reinforced concrete beam than 42 days in the open air, during tests at the Technical High School in Vienna.

One of the greatest difficulties in manufacturing of concrete products has been the extensive space required for storage during the process of curing, as a month's production must be on hand continually. If this can be accomplished in six hours under steam pressure, an important step ahead in this comparatively new branch of manufacturing has been made.

The report reads further:

> After the reinforced concrete product has been finished in

the usual manner, and has an initial set so as to be moved, it is placed on a handcar and shoved into the curing boiler, where for several hours it is exposed to a steam pressure of nine atmospheres, when the hardening is finished and the article ready for use. The steam cure is a result of the hardening process of the cement under the influence of the hot steam, and the uniformity of the hardening in all directions simultaneously, also in the inside of the body. The conditions of strength and bond will after a few hours equal those obtained by usual curing in the air lasting several weeks.

Inasmuch as less concrete is required under conditions of steam curing, a reduction of shrinkage follows, and at the same time of surface cracks. As the expansion of concrete is slightly less than that of steel, the result is a hardening or cure practically without shrinkage stresses, and accordingly an almost perfect absence of surface cracks.

The importance of this discovery and its practical value will effect great economical changes in our concrete products factories of the present and future.

[Investigations of high pressure steam curing by the Bureau of Standards and other agencies in the United States several years ago were not encouraging from a commercial standpoint—the expense entailed in the installations for treatment of products by this method, and, as is now recalled, an element of uncertainty in the response of some cements to the treatment.—Editor.]

The Latest German Grain Elevator Construction

Instead of ventilating the grain by elevating to keep it from heating during long-time storage, elevators are being built with walls of hollow concrete tiles, communicating air spaces being provided so that a current of air constantly may extract moisture from the stored contents, according to Technical Director K. Steppes in *Beton und Eisen.*

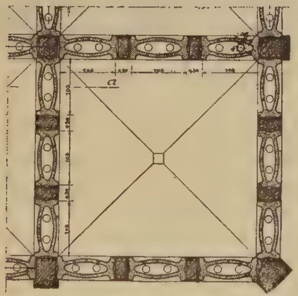


Fig. 1—Horizontal Section of Grain Bin

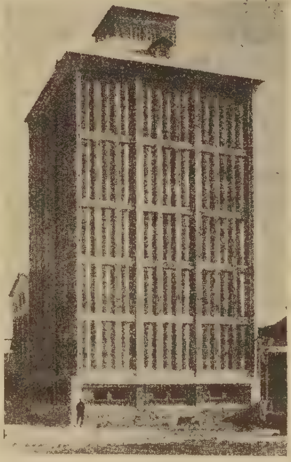


Fig. 2—Elevator Erected by This System

Fig. 1 gives a horizontal section of a grain bin, and Fig. 2 a photographic view of the elevator built for the A. Kallenberg flour mills at Langensalzen.

Some saving in the cost of construction is claimed by the fact that only the skeleton structure need be reinforced, the vertical corner columns and the horizontal and vertical ribs. A saving is also claimed in forms (but when our American method of sliding forms is considered, this item surely will appear on the opposite page of the ledger).

In some particular flour mill drying bins, the German idea may, however, show itself of some virtue, but for country elevators, where any ledge or pocket, hole or other depression may prove a resting or breeding place for weevils or other enemies to the grain, the smoothness of our concrete walls presents a safeguard of the greatest value.

That the construction described also forms inaccessible places, where dust may gather, is evident, and in the face of the frequency of dust explosions, this objection should carry considerable weight.

Reinforced Concrete Unit Frame Work in Austria

(*Tonindustrizeitung*)

The concrete unit systems in the United States have suggested the development in Austria during the past two years of a system of reinforced concrete frame construction which appears quite interesting.

Concrete Unit Construction Factory at Lobnitz

Rudolf Winternitz, of Vienna, originated the idea, which was taken up by the Universal Construction Co., and quite a number of important structures have been erected with great success.

The illustration shows the frame work of a factory in Lobnitz, the photograph taken during erection. No effort is spared in saving in the dead weight of the construction by careful computations.

Margalit Oilproofing of Concrete Oil Storage Tanks

(*Tonindustrizeitung*)

After plastering the inner surface of the concrete tank with a thin coat of 1:1 or 1:1½ portland cement mortar, well troweled on with an iron trowel, the tank is left to cure for a space of two or even three weeks, the surfaces being kept moist by sprinkling for the first week.

While the tank by this time may be waterproof, it by no means is impervious to oil or distillates, nor to diluted mixtures of acids. Neither varnish, soap solutions, asphalt or other paints have given any lasting satisfaction in this respect, and this want of a suitable oilproof covering has made itself felt as a great obstacle to the use of concrete in floors for machine shops, tanks and reinforced concrete ships.

After many years' experiments and tests, Professor Dr. Marcusson finally adopted Margalit as the lining which covers every demand of the stored liquids.

Margalit has a consistency of molasses and is applied like paint with a brush. Its action is antiseptic. As the material rapidly becomes sticky and heavy, it is kept in small pots into which is dipped the brush, while a small quantity of alcohol is added from time to time.

The first coat is made very thin, but so as to cover the entire surface as completely as possible, whereby the pores are entirely filled. The scond coat is added one day later, and on very rough surfaces a third coat is added the third day.

After one week the tank is absolutely oiltight, as the Margalit by oxydation and polymerisation in the air changes into an insoluble substance. Tanks lined in this manner have proved impervious to crude oil, fuel oil, benzin, petroleum, lubricating oil, linseed oil, cotton seed oil, and cod liver oil. Chloride and sulphide of lime have no effect on the lining, but oils of considerable phenol contents, like creosote, as well as alcohol, affect the lining.

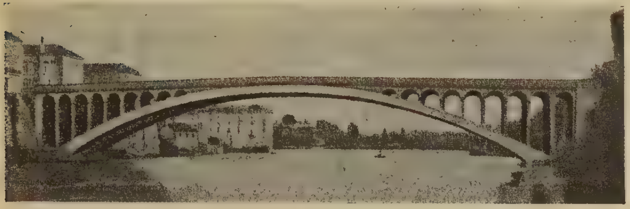


Fig. 1—An Unusual Concrete Bridge in France

A Remarkable Concrete Bridge at Villeneuve, Southern France

(After Regierungsbaumeister R. Fischer, in *Der Bauingenieur*)

The 310 ft. span bridge over the river Lot at Villeneuve is most remarkable in having the largest plain concrete arch span in the world, consisting of two independent plain concrete arches of dimensions at the crown of 10 ft. by 4 ft. 9 in., and at the haunches 13 ft. by 10 ft.

Fig. 1 shows the very attractive elevation, Fig. 2 a view from below, and Fig. 3 a cross section at the crown.

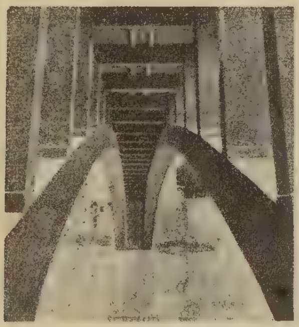


Fig. 2—Under the Arch

The roadway is carried on an 8½-in. reinforced concrete slab, and has a macadam driveway as well as tracks for a street railroad. The constructor, Mr. Freyssinet, made use of his own system of arranging the false work and forms, and instead of lowering the false work, he raises the arches away from the form, by leaving a joint at the crown and inserting four jackscrews operated hydraulicly, in recesses left for the purpose at both sides of each arch, as indicated in Fig. 4.

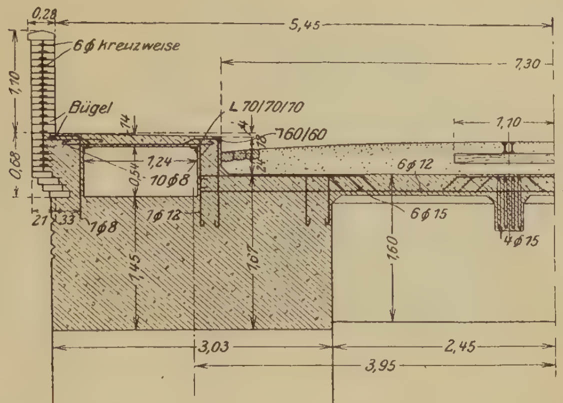


Fig. 3

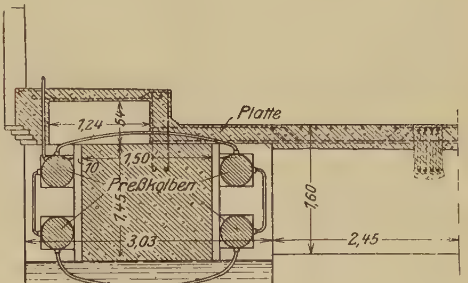


Fig. 4

By opening the joint ⅞ in., the arches were raised under additional pressure 3½ in. from the form work, and the forms and false work were removed without difficulty.

This method also gave the constructor the opportunity to verify his calculations as to the dead load strains computed in the arches.

By the simplification of the false work attained by its novel removal, the constructor states that the principal objections to concrete spans of 160 ft. or more are removed.

Reinforced Concrete Chimneys With Precast Unit Forms

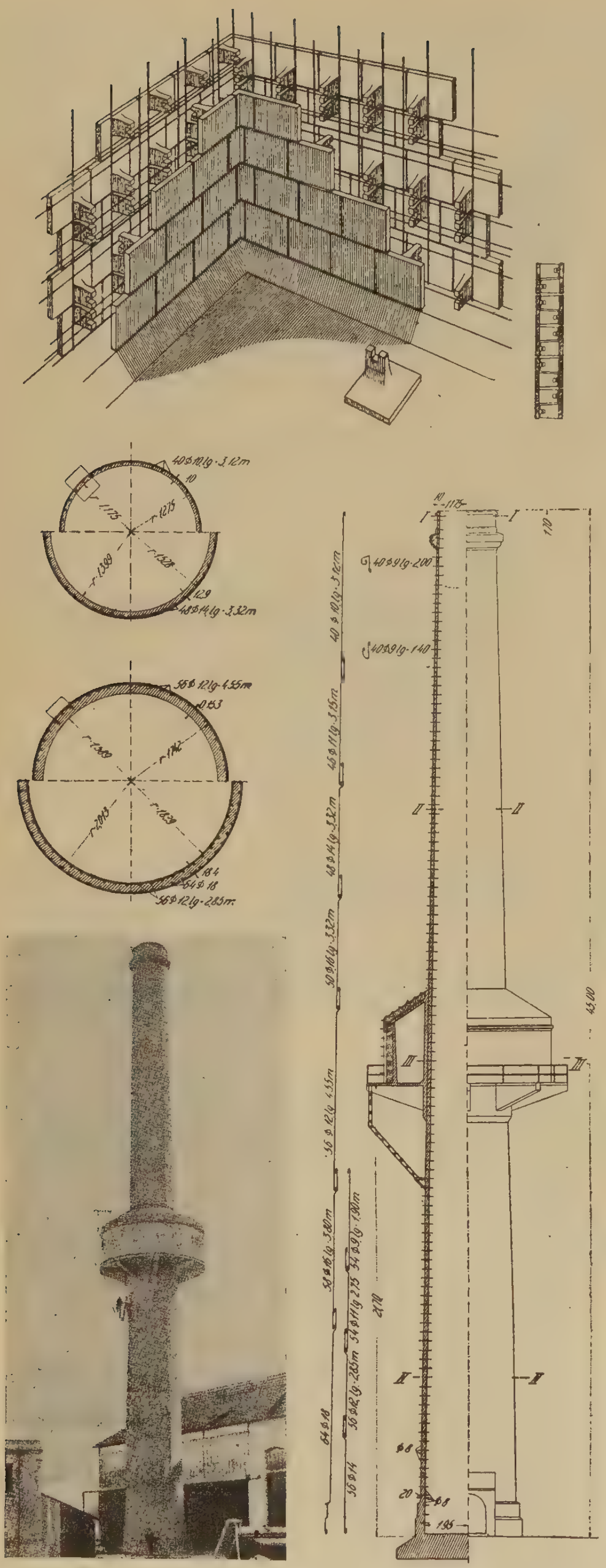
(Prof. Louis Perrin, Geneva, in *Beton und Eisen*)

At the Beha works in Remimont (The Vosges), the chimneys destroyed during the war are replaced in reinforced concrete without the use of removable forms. Concrete tiles 10 in. by 12 in., with projections for supporting the horizontal reinforcing rods, are placed inside and outside the concrete core, in layers two high, and concrete of a consistency of moist earth tamped down between the tiles.

Fig. 1 shows a perspective view of the tiles assembled, and also a cross section of several ties placed on top of each other. A single tie is shown in the foreground. Fig. 2 shows sections of the chimney with the tiles forming the outer and inner surface. Fig. 3 gives a section and Fig. 4 the elevation of the entire chimney.

Near the middle height of the stack is located a water reservoir of the construction shown in Fig. 5. The principal dimensions of the structures are:

Height above ground, 150 ft.; height of the reservoir, 72 ft.; outside diameter at base, 14 ft. 6 in.; outside



Reinforced Concrete Chimney, with Precast Unit Forms—Fig. 1, Top; Fig. 2, Center Left; Fig. 4, Right; Fig. 5, Left

diameter at top, 7 ft. 6 in.; wall thickness at base, 7¾ in.; wall thickness at top, 4 in.; capacity of reservoir, 13,000 gals.; cost of chimney, 45,000 francs.

The computations were based upon a stress of 720 lbs. per sq. in. in concrete and 17,200 lbs. per sq. in. in steel. The wind pressure was assumed at 20 lbs. per sq. ft.

The appearance of the chimney is that of a Custodis stack, and when properly designed and executed should give good service.

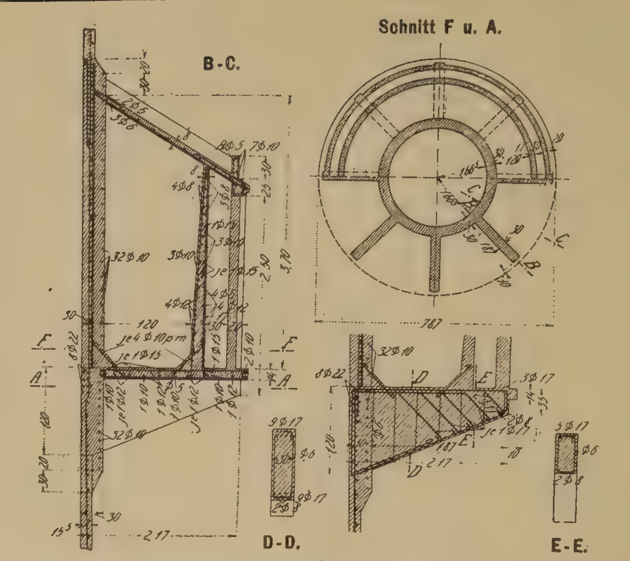


Fig. 3—Reinforced Concrete Chimney

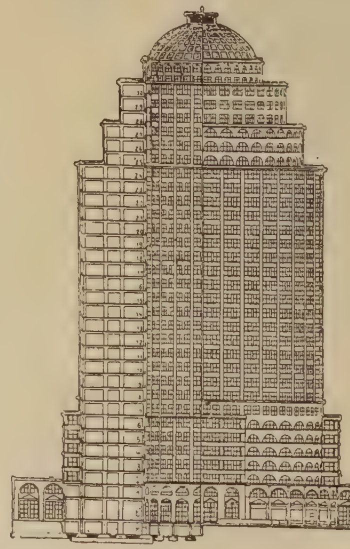
Thirty-Story Concrete Exposition Building Projected for the Leipzig Fair

An illustration shows a sketch of the projected reinforced concrete tower in connection with the lay-out for the fairs held from time to time in Leipzig.

Tonindustri-zeitung advises that this building is to be 410 ft. high and have a center shaft 200 ft. in diameter, around which six groups of warehouses or shelters for exhibits are placed, one on top of the other and each five stories high, a total of thirty stories.

The communications for persons and traffic in each group are arranged as though the group or five-story building were placed on the ground, and the main reason for the peculiar arrangement is the lack of floor area on the exposition grounds, which are shown in Fig. 2, which shows the location of the projected tower as well.

The designing engineer, Mr. Haimovici, has arranged

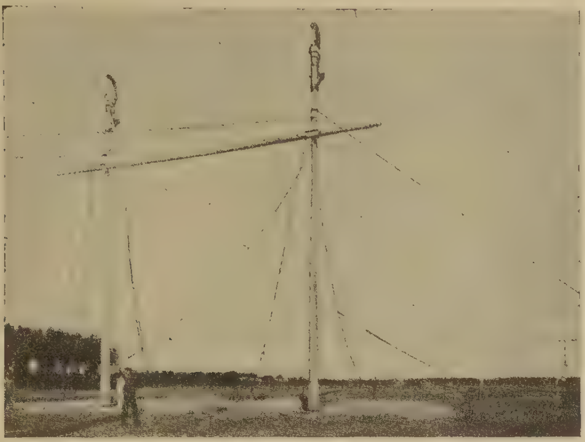


30-Story Tower

for the transport of passengers and freight for the different groups by an interesting distribution of express and local elevators.

Reinforced Concrete Poles for Power Transmission in Sweden

Der Bauingenieur describes the transmission poles for the power transmission from Trollhattan to Vaesteros, 320 kilometers long, and finished in 1921.



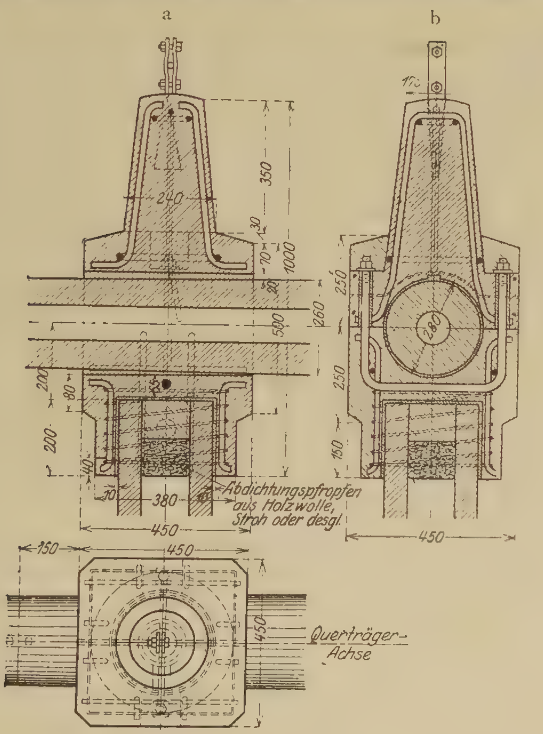


Fig. 1 (Top) and Fig. 2 (Below)—Power Transmission Poles

Fig. 1 shows the erection of two poles constituting a support for the traverse or cross beam, all made like hollow pipes by the centrifugal process. The poles are 62 ft. long, 21 in. outside diameter at the bottom and 10 in. at the top, with an average thickness less than 2 in. Five and six-tenths per cent of the total number of 800 poles were tested to a load six to eight times greater than the maximum actual stress at the top.

Fig. 2 shows the connection between pole and traverse. The poles were manufactured in Germany.

C. A. Heise, CONCRETE'S Berlin Correspondent, Dies

Announcement is made of the sudden death from heart failure of C. A. Heise, a German engineer, who has been CONCRETE'S Berlin correspondent. His work is taken over by F. A. Brackmann, an engineer who has been associated with Mr. Heise for a number of years. He is taking up and promises to report soon on several matters of a good deal of technical interest to CONCRETE'S readers—developments in which more progress has been made by workers with cement in Germany than in this country.

Tests of Bricks Made From Slag

For utilization of blast furnace slag in making slag bricks, the following scheme is proposed by E. P. Gangewere, Lehigh University, who has patented the idea:

1. Discharge slag directly from furnace into cars filled to depth of several feet with water.
2. Place disintegrated slag into centrifugal drier.
3. Run product through pulverizer, crushing slag to such a degree that 75% will pass through a 100-mesh sieve.
4. Mix 1 part of cement to 12 parts of powdered slag, adding small amount of water.
5. Mold the resulting mixture in presses to bricks of standard size.

The bricks thus produced from slag of Bethlehem Steel Co. furnaces at Bethlehem, Pa., have been tested at the Fritz Engineering Laboratory at Lehigh University by Mr. Gangewere, who reports the following results:

Transverse tests, with supports ⅝ in. from each end; width, 2 5/16 in.; depth, 4 in.; span, 7 in.; average breaking load, 7,000 lbs.

Compression test with bricks set on edge after being broken in half. The following area was subjected to compression: Length, 4 3/16 in.; breadth, 2 5/16 in.; average breaking load, 80,000 lbs., or ultimate strength of 8,500 lbs. per sq. in.

Absorption test: In a period of 11 days the bricks absorbed 7.15% of their weight in moisture.

In subjecting the bricks to a double-shearing test they failed at a unit load of 1,650 lbs. per sq. in.

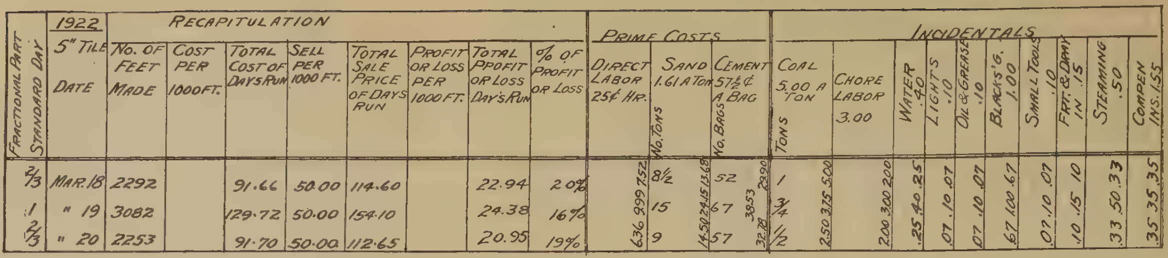
The results are taken to show that bricks produced from blast furnace slag have a strength far above the average produced from shale or clay. The texture of the bricks is uniform, and an even, smooth surface results from this method of manufacture.

The cost of producing this product is claimed to be far less than that involved in making bricks from clay or shale, and the whole process can be operated in conjunction with any blast furnaces.

The specifications of the American Society for Testing Materials for vitrified building brick call for 5,000 lbs., the average minimum compressive strength, tested on edge, and an absorption limit of 5% or less after five hours' boiling, or 5% to 12% in the case of hard brick.

The United States Government investigated the cost of making common clay brick on the Hudson River in 1920, and found it to be $13.19 per thousand, plus $3.93 per thousand for barge transportation to New York, making the delivered cost $17.12 per thousand. Such brick is now selling at $18 to $24 retail, while a good grade of vitrified brick will bring around $40.—*Iron Age.*

FIG. 8—COST ESTIMATE SHEET (READ ACROSS THIS AND OPPOSITE PAGE)



	1922	RECAPITULATION								PRIME COSTS					INCIDENTALS										
FRACTIONAL PART STANDARD DAY	5" TILE DATE	NO. OF FEET MADE	COST PER 1000 FT.	TOTAL COST OF DAYS RUN	SELL PER 1000 FT.	TOTAL SALE PRICE OF DAYS RUN	PROFIT OR LOSS PER 1000 FT.	TOTAL PROFIT OR LOSS DAY'S RUN	% OF PROFIT OR LOSS	DIRECT LABOR 25¢ HR.	SAND 1.61 A TON NO. TONS		CEMENT 57½¢ A BAG NO. BAGS		COAL 5.00 A TON TONS		CHORE LABOR 3.00	WATER .40	LIGHTS .10	OIL & GREASE .10	BLACKS'G. 1.00	SMALL TOOLS .10	FRT. & DRAY IN .15	STEAMING .50	COMPEN INS. 1.55
2/3	MAR. 18	2292		91.66	50.00	114.60		22.94	20%	7.52	8½	13.68	52	29.90	1	5.00	2.00	.25	.07	.07	.67	.07	.10	.33	.35
1	" 19	3082		129.72	50.00	154.10		24.38	16%	9.99	15	24.15	67	38.53	¾	3.75	3.00	.40	.10	.10	1.00	.10	.15	.50	.35
2/3	" 20	2253		91.70	50.00	112.65		20.95	19%	6.36	9	14.50	57	32.78	½	2.50	2.00	.25	.07	.07	.67	.07	10	.33	.35

Cost Accounting in Products Manufacture

Third Article

By Mac Hanson

In the two previous parts of this article we designed and discussed forms for the Estimate Sheets of the Cost of Raw Materials, Cost of Annual Overhead Expenses, and Cost of Production. We are now ready to design and discuss the Cost Accounting Cost Estimate Sheets themselves. These Cost Estimate Sheets of Manufacturing will be six in number—one for each size of tile made. All six will be exactly alike, so we will illustrate that for 5-inch tile only. A multi-column book may be used, or printed forms may be designed. But for those who do not care to go to this expense, we will describe the process of drawing forms by hand, which will give you as neat and accurate records as printed forms.

Unfold a double sheet of fool's cap paper with the inside pages face up. Paste another half-length onto the end of this. Between the two marginal rulings draw lines with a black pencil the full length of the sheet. Make these lines 3/8 in. apart. Then rule the sheet crossways the full width with black pencil. Make the first cross-ruling one line wide. The next 14 rulings two lines wide. The next 57 rulins one line wide. (Not all of the 57 are shown in the reproduction, Fig. 8, as part of the spaces being left blank by Mr. Hanson space was saved in the omission.) The next three rulings two lines wide.

These cross rulings will be set apart by colored lines into twelve sections, headed as shown in the cut FIG. 8. In the Recapitulation Division all entries are written lengthway of the sheet so that they will add down the crossways columns. In all the other divisions the entries are made crossways of the sheeet so that they will add down the lengthways columns. When the sheet is filled all crossways columns should be totaled at the bottom of the sheet below the narrow marginal ruling and these totals carried to the new sheet for 5-inch tile. At the end of the month the cross columns should be totaled and averaged to make comparison with the Cost Accounting Actual Expenses Sheets to be described later. As shown in FIG. 8 the column headings are all written above the top or wide marginal ruling. The ruling and heading of this sheet will require about 45 minutes and it is good for 18 days' entries.

Under the heading "Sand," the left hand side of the column is used to enter in red the number of tons of sand used. The right hand side is used to enter in black the cost of the sand used. The same system is used under Cement and Coal, and may be used under Direct labor and Chore Labor.

Under this system of cost keeping it is assumed that practically all the tile made in one year will be sold in that year. That is to say, it is pressumed that the inventory at the end of the year will be about the same as at the beginning of the year.

It often happens that a manufacturer intends to make up more tile than he expects to sell that year. He may intend to carry a larger stock than formerly; or to increase the length of the seasoning period; or to stock up heavily in anticipation of a good trade next spring. Let us assume that he intends to manufacture 200 standard days' output of tile but expects to sell only 150 days' output. In this case his figures for Manufacturing Expenses—i. e., Incidentals, Variables, and Fixed Charges—on his Overhead Expenses Estimate Sheet, FIG. 4, are correct. But if his Administration and Selling Expenses were based on 200 days' output (as is the case in our FIG. 4) then these Administration and Selling Expenses are estimated too low for this assumed case. They should have been spread over only 150 standard days' output, in such a case.

You understand, of course, that the Administration and Selling Expenses may be, in actual practice, spread out over the 300 calendar days of the year, but since our basis of distribution of expense was the "standard day's output"—a production basis— we must of course spread the year's Administration and selling expense over these 150 standard days' production which we expect to sell. Another thing. If a manufacturer figures on selling 150 days' output, but when the year is over finds that he has sold only 100 days' output, he is then in bad. There is, however, no way of avoiding such a contingency. Every manufacturer must guess, in advance, what his year's business will be and then turn heaven and earth to make his wish come true. Naturally, any trend of the trade that develops at any time or over any period of time will be the cause of adjusting the Estimate sheets at once, either up or down, and enough to bring the average to the point desired. This contingency is the reason why a manufacturer must figure conservatively and take as long a profit as the traffic will bear.

On the back of this Accounting Form, Fig. 8, should be written its title, viz.:

Cost Estimate Sheet
of
5-inch tile
1922.

This form could be greatly reduced in length and the labor of making entries to it could be cut in half by entering the Manufacturing Expenses, Administration and Selling Expenses as totals instead of by items. But we strongly advise against this for the following reason. If you use this latter method, then when this Cost Estimate Sheet was compared to the Actual Expenses Sheet, as it should be done at least quarterly and preferably monthly and it was found that the Incidentals, for instance, on the Estimate Sheet was considerably greater than the Actual incidentals, you would have no means of knowing where nor why. And if a cost accounting system doesn't tell you where and why it has failed in two-thirds of its possible usefulness.

VARIABLES					FIXED CHARGES								TOTAL COST PRODUCTION	ADMINISTRATIVE EXPENSES													SELLING EXPENSES										TOTAL COST OF GOODS SOLD	TOTALS		
RS TO MCHY. .25	INT. MONEY PROD. 3.00	TAXES 1.00	CULLS & BKG 5.00	YARD LOSS 1.00	RPR'S BLDG. .50	DEPREC BLDGS. 1.00	DEPREC. MCHY. 2.50	INT. ON INVEST. 0.00	BOILER INS. .25	FIRE INS. .25	TORNADO INS. .05	SUPT. SALARY 4.00		OFFICE OVERHEAD .40	OFFICE SUPPLIES .10	MGR. SALARY 10.00	CLERK SAL. 2.60	AUTO EXPS. .50	R.R. FARES .25	DONATIONS CHARITY .50	ASSN. DUES & EXP. 1.00	LIFE INS 2.50	LEGAL EXP. .50	PHONE & GRAMS. .25	HEAT, LT. & WATER .50	COMPEN INS .05	OFFICE OVERHEAD .10	OFFICE SUPPLIES .10	MGR SAL. 2.50	AUTO. EXPS. 1.00	ADVER 1.00	COLLECTING .25	BAD ACCTS. 1.00	ADJ. & DISCTS .50	LOADING OUT 1.00	FREIGHT OUT 2.00		COST	PROFIT 10% SALE PRICE	SALE PRICE
.16 .25 .16	2.00 3.00 2.00	.67 1.00 .67	3.35 5.00 3.35	.67 1.00 .67	.33 .50 .33	.67 1.00 .67	1.67 2.50 1.67	- - -	.17 .25 .17	.17 .25 .17	.03 .05 .03	2.67 4.00 2.67	101.12 72.61 72.57	.26 .40 .26	.07 .10 .07	6.67 10.00 6.67	1.73 2.60 1.73	.33 .50 .33	.16 .25 .16	.33 .50 .33	.67 1.00 .67	1.67 2.50 1.67	.33 .50 .33	.17 .25 .17	.33 .50 .33	.03 .05 .03	.07 .10 .07	.07 .10 .07	1.67 2.50 1.67	.67 1.00 .67	.67 1.00 .67	.17 .25 .17	.67 1.00 .67	.33 .50 .33	.67 1.00 .67	1.35 2.00 1.35	129.72 91.70 91.66	129.72 91.70 91.66	14.41 10.19 10.19	144.13 10.89 10.85

At the end of the year a similar sheet should be used for gathering the totals of all sheets into a recapitulation. This recapitulation sheet will be your annual statement of Actual Prime Costs, and Estimated Manufacturing Expenses, Administration and Selling Expenses.

The Cost Accounting Actual Expenses Sheets are not kept separately for each size of tile, except that the Prime Costs shown on the various Cost Accounting Cost Estimate Sheets are also the Actual Prime Costs. These Actual Expenses Sheets will have to contain lump sum entries of actual expenses as those expenses occur. The source of such entries will be the Factory Operation record, the Invoice File, and the Perpetual Inventory.

Fig. 9 herewith, is a design of a form to record Actual Manufacturing Expenses. As illustrated, it keeps the Incidentals, Variables, and Fixed Charges separated. Entries will be made only as actual expenses occur, and should then be made no matter if payment is delayed until later. The monthly totals will be the lump sum expenditures covering the production of all sizes of tile manufactured in that month. In order to compare these totals with the Estimate Sheets it will, of course, be necessary to total the Estimated Expenses on all the tile sheets which carry entries for that period.

These Estimate Sheets may be corrected to fit the Actual Expenses Sheets each month on such items as water, lights, etc., because those items should not vary greatly from month to month. But on such items as taxes, repairs to buildings, etc., good judgment must be used, as entries to these items occur only at rare intervals. If items on the Estimate Sheets are too low as compared to the Actual Expenses Sheets any month, they had better be raised for safety's sake. But if they are too high, they had better be left high, for safety's sake, unless they are unquestionably too high.

Actual Expenses Sheets for Administration and for Selling Expenses also for Chore Labor should be kept. They will be quite similar in design to Fig. 9. All Actual Expenses Sheets should be recapitulated at the end of the year, the totals thereon distributed to the various sizes and amounts of tile made during the year and an Actual Cost Accounting Manufacturing sheet produced. This sheet and the recapitulation sheet mentioned before will form the basis of making out your estimate sheets for the new year.

In addition to the Cost Accounting sheets named I have found it advisable and very profitable to keep a Delay Sheet and a separate Auto Expense Sheet. Among other things, your superintendent should enter upon his Factory Operation Record any and all delays to production, the cause and the number of minutes lost. Your clerk can then design a columnar sheet to record these delays. She should rule it with two line columns for each cause of delay. In the left hand line she should enter the total man hours of labor expended in correcting the cause of delay. In the right hand side the amount of wages so spent. We found some twenty or more causes of delay that occurred more or less regularly, such as waiting for steam, changing heads, wet concrete, dry concrete, quarter twist belt trouble, etc.

To illustrate the value of such a sheet let me tell you of the quarter twist belt. It was a five ply, six inch, rubber covered belt running on steel split pulleys sixteen inches in diameter, but only four feet apart. It pulled

PRODUCTION COST ESTIMATE SHEET BASED ON 200 DAYS OPERATION.

SIZE	5	5	5	6	6	6	7	7	7	8	8	8	10	10	10	12	12	12
WEIGHT PER FT.	10 LBS.			12 LBS.			15 LBS.			20 LBS.			36 LBS.			44 LBS.		
NUMBER FT. PER DAY	3000	3250	3500	2500	2750	3000	2200			1800			1200			800		
NUMBER FT. PER SACK	40			33			27			20			12			9		
NUMBER OF MEN	4			4			4			4			4			4		
POUNDS SAND PER FT.	7½			9			11¼			15			27			33		
WAGES $2.50 A DAY	10.00	10.00	10.00	10.00			10.00			10.00			10.00			10.00		
SAND 1.61 A TON	11¼ TON 18.11	12⅕ TON 19.64	13⅛ 21.13	11⅖ 18.35			12¾ 20.53			13½ 21.74			16⅖ 26.40			13⅖ 21.57		
CEMENT 57½¢ SACK	75 SACKS 43.13	81 SACKS 46.58	87½ 50.31	83 47.73			82 47.15			90 51.75			100 57.50			89 42.33		
SUPPLIES	2.50	2.50	2.50	2.50			2.50			2.50			2.50			2.50.		
INCIDENTALS	9.65	9.65	9.65	9.65			9.65			9.65			9.65			9.65		
VARIABLES	10.25	10.25	10.25	10.25			10.25			10.25			10.25			10.25		
FIXED CHARGES	8.55	8.55	8.55	8.55			8.55			8.55			8.55			8.55		
ADMINISTRATIVE	19.15	19.15	19.15	19.15			19.15			19.15			19.15			19.15		
SELLING	9.45	9.45	9.45	9.45			9.45			9.45			9.45			9.45		
TOTAL COST DAY'S RUN 90% SALE PRICE	130.79	135.77	140.99	135.63			137.23			143.04			153.45			133.45		
PROFIT PER DAY'S RUN 10% SALE PRICE	14.53	15.08	15.68	15.07			15.26			15.89			17.05			14.83		
SALE PRICE OF A DAY'S RUN	145.32	150.85	156.67	150.70			152.49			158.93			170.50			148.28		
TOTAL COST OF 1000 FT.	43.60	41.78	40.28	54.25			62.38			79.46			127.87			166.81		
PROFIT PER 1000 FT.	4.84	4.64	4.48	6.03			6.93			8.83			14.21			18.54		
SALE PRICE PER 1000 FT.	48.44	46.42	44.76	60.28			69.31			88.29			142.08			185.35		
TOTAL COST PER TON	8.72	8.35	8.05	9.06			8.30			7.95			7.10			7.58		
PROFIT PER TON	.97	.93	.90	1.01			.92			.88			.79			.84		
SALE PRICE PER TON	9.69	9.28	8.95	10.07			9.22			8.83			7.89			8.42		

FIG. 7 — REPUBLISHED FROM JULY ISSUE, WITH CORRECTIONS

, 1922	INCIDENTALS								VARIABLES											FIXED CHARGES										
ACTUAL MFG. EXPENSES									REPAIRS TO MACH'Y.						TAXES					REPAIRS TO BLDG.										
WEEK ENDING	WATER	LIGHTS	OIL & GREASE	BLACKSMITHING	SMALL TOOLS.	FREIGHT AND DRAYAGE IN	COMPEN. INS.		LABOR	MATERIALS	SUPPLIES	GENERAL EXP.	TOTAL	INT. ON MONEY IN TILE	TAXES ON TILE	TAXES ON BLDG. & MACH'Y	TOTAL	CULLS AND BREAKAGE	YARD SHORTAGE	LABOR	MATERIALS	SUPPLIES	GENERAL EXP.	TOTAL	BOILER INS.	FIRE INS.	TORNADO INS.	SUPT. SALARY		TOTAL
1ST. WEEK																														
2ND. "																														
3RD. "																														
4TH. "																														
5TH. "																														
FIRST MO. TOTAL																														
1ST. WEEK																														
2ND. "																														
3RD. "																														
4TH. "																														
5TH. "																														
SEC. MO. TOTAL																														
2 MOS. TOTAL																														
1ST. WEEK																														
2ND. "																														
3RD. "																														
4TH. "																														
5TH. "																														
THIRD MO. TOTAL																														
3 MOS. TOTAL																														

Fig. 9—Actual Manufacturing Expense

the mixer and bucket elevator that conveyed the concrete up overhead the tile machine.

The strain on it caused it to slip off the pulleys quite frequently and to tear out its laces every few days. But the delay at any one time was usually only from three to ten minutes, occasionally longer. So we put up with it as it was.

The superintendent was entering all delays on the Factory Operation Record for his own good—a sort of alibi if I happened to ride him hard—but we were not keeping a delay accounting sheet that year. At the end of the year, my clerk and myself ran up a complete delay sheet for the year due to the continuous urging of the superintendent. The wages I lost of account of this belt alone totaled over $60.00 to say nothing of the loss occasioned by lowered production from loss of time and ill humor of the men. We spent about $20.00 in raising the upper shaft some five feet and have been bothered very little by this belt since. We did several other things after studying the delay sheet—such as coating the boiler walls, heightening the stack, and buying a better grade of coal—but this belt case well illustrates the advantages of a delay sheet.

Our Auto Expenses sheet taught us that if it was costing over ten cents a mile to operate the car, whereas we had fondly thought we were getting by at half of that. Whoever ran the car had to make entries in a pocket note book kept in the car, showing the date, where and why run, number of miles, gas and oil bought, gallons of gas used, tire and tube record, etc. The clerk designed a columnar form showing all these items and also about a dozen more expense items which, we discovered, were incurred in operating a car, and she made entries to this sheet weekly from the note book and invoice file. Periodically the actual cost per mile of operating the car was determined and this expense charged,on the basis of number of miles used, to my personal use, to general factory use, to Administrative expense, to Selling expense, etc.

The system outlined in these articles consists chiefly of Cost Estimate Sheets and Actual Expenses sheets to correspond. There are but four of each, viz.; Cost Estimate Sheet of Raw Materials, Fig. 1, Cost Estimate Sheet of Annual Overhead Expenses, Fig. 4, Production Cost Estimate Sheet, Fig 7 (Fig 7 is republished this month with correction of errors in "8 in. size" column) and Cost Accounting Estimate Sheets (Manufacturing Estimate Sheets), Fig. 8. And the Actual Expenses Sheets to correspond. After getting used to them any ordinary clerk can keep them up by a few hours a week.

Did you ever take on a big order early in the year, and finally get operations running along nicely with a decent daily production, and feel good because you were making a nice fat profit? Did you occasionally, in the joy of your heart, sit down, after the men had all left for the evening, and figure up the amount of sand, cement, coal, labor, and water you had used that day, and feel satisfied with life because of the way profits were piling up?

And then at the end of the year, after the job had been completed and delivered and you had collected your accounts receivable and paid off a lot of your bills, did you ever, with a worried, anxious frown, sit down and total your resources and liabilities and find that instead of making a profit you were actually worth less than at the beginning of the year? And for days you went around in a sort of daze, and wondered why, and wondered, and wondered! That's all you could do for you had no sort of a cost accounting system at all to tell you why, and where.

What did you do about it? Did you go on in the same old rut next year, or did you solemnly swear that one such bitter experience was enough, and that next year you would keep records that would let you know definitely each day whether you were making or losing money?

Every manufacturer of good common sense—and we all belong to that class—of course, realized the folly of a hand to mouth, slip-shod, hit and miss, happy-go-lucky way of doing business. And if such a manufacturer did not install a good cost accounting system it was because he did not know how. This system here presented was born of such an experience. It has been improved by the experience of several years' use.

Start your cost accounting system today. Alter or enlarge upon this system to suit your business. Don't condense it much more because we have condensed and simplified it as much as we dare from our experience. Any further simplification will seriously impair its usefullness. If it doesn't tell you what, and where, and why your profits and losses are, then it is of no use as a guide in managing.

Racine, Wis., has made and installed several traffic signals of reinforced concrete in two pieces, an octagonal dome and a base. The dome has light holes vertically through the center, and inclined on all four sides. The lenses in these holes are countersunk. Brass bolts clamp the dome to the bottom section, which is hollow, to contain the electric light. A 10-ton roller driven over one recently did not harm it to any appreciable extent.—*Contractor's Atlas.*

Trade Publications

A reprint of the *Discussion on Integral Waterproofing of Concrete,* submitted by R. A. Plumb to the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, has been issued by the Truscon Laboratories, Detroit, Mich., for distribution among those who have technical interest in the subject.

The paper defines porosity and gives a theoretical discussion of waterproofing cement and cement mortar together with data of tests tending to prove the author's theory. A statement of the effects of water on concrete under practical conditions, is also included.

Exceptions are taken to Technologic Paper No. 3 of the Bureau of Standards, on the grounds that tests on a few ineffective compounds should not be the basis of a wholesale criticism of integral waterproofing.

The results of laboratory tests on samples that show a marked reduction in absorption due to the integral presence of water repellant compounds are outlined.

The results of various investigations to determine the attitude of engineers, architects and contractors towards integral waterproofings, that show a majority of those responding to inquiry to be in favor of this proposition, are included.

As a technical man who has made a long and thorough study of his special subject, Mr. Plumb may perhaps be open to criticism for his use of the term "porous" in relation to concrete throughout the discussion. "Porous" is of course a relative term. The *extent* of its porosity is the determining factor. To control that *extent* of porosity as required by the work in hand, is the problem of the engineer, in solving which he may adopt any one of several means, either with or without special admixtures, as the service of the work requires, and as the relation of the available materials to the economy of the job may indicate.

Spring Activities, No. 30, of the *Alpha Aids* contains house, pergola, swimming pool and garden seat plans, with directions for building. Some information on mailing lists and business getting schemes of interest to material dealers is also included.

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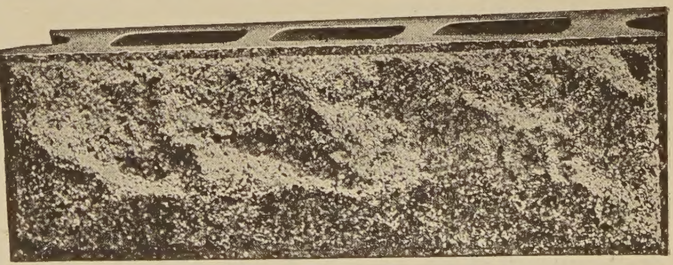

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New Books

Kidder's Architect's and Builders' Handbook, 17th Edition—Edited by Thomas Nolan and a staff of specialists; John Wiley & Sons, New York City; 4½ in. by 7 in.; profusely illustrated; 1,907 pp., bound in semi-flexible black leather.

Almost everyone who has occasion to use a reference work on building construction knows "Kidder." In this edition, issued recently, the name is changed from "Pocketbook" to "Handbook."

Part II, on the strength of materials and the stability of structures, has been revised to make the data agree with the latest research and practice, and two new chapters, on specifications for steel work of buildings and on domical and vaulted structures have been added. Part III, useful information for architects, builders and superintendents, has been improved by entirely rewriting the chapter on Heating and Ventilating. The new chapters and sections include practical examples of every-day problems, with solutions worked out in full detail.

In addition, numerous new articles have been added to the texts and illustrations of Part II.

In its revised, compact, and convenient form, this work, more than ever, should maintain its pre-eminence as the authoritative Handbook of Building Construction.

Materials of Construction—A. P. Mills, 2nd edition, edited by Harrison W. Hayward; John Wiley & Sons, New York City; 476 pp.; 6 by 9; 192 figs.; cloth binding, $4.00 postpaid.

The original work of the late Professor Mills has proven of much value to students and engineers, and this edition, issued January, 1922, in its revised form shrould have a renewed value to students in materials as well as to every engineer engaged in structural work.

No fundamental changes have been made in this revision, which contains new material prepared by the editor, Professor Hayward, and other members of the faculty of the Massachusetts Institute of Technology.

Manufacturing processes are treated with sufficient detail for the general engineer or student, but the book does not take up chemistry or metallurgy to such an extent as to make the work unintelligible to this class of readers.

The scope of the book is indicated by the chapter titles: Plaster, lime, natural cement; Portland cement and concrete; Stone; Bricks and other clay products; Ferrous metals; Non-ferrous metals and alloys; Timber; Rope; Mechanical fabrics.

Practical Structural Design, 2nd Edition—Ernest McCullough, U. P. C. Book Co., 243 West 39th St., New York City; 6 in. by 9 in.; 320 pp., 200 figs.; cloth, $3.00.

This is an elaboration of the notes by which the author taught the principles of structural design to aspiring draftsmen and others whose knowledge of mathematics was limited to that taught in high school. The author's experience in this line extended over a number of years, and his efforts were very successful. The book gives a complete system for the design of beams, floors, girders, trusses, columns, walls, foundations, footings, etc.

The mistakes of the first edition have been corrected and the entire book revised and enlarged by the addition of a chapter dealing with semi-rigid frames.

This work can be recommended to the man who desires to obtain a complete working knowledge of structural design, in spare time, by his own efforts.

Reinforced Concrete Simply Explained—Oscar Faber, Oxford Technical Publication, Oxford University Press, 35 West 32nd St., New York City; 5¾ in. by 8¾ in., 74 pp., illustrated; bound in stiff boards.

Another exposition of the principles of reinforced concrete design in simple terms. It is intended for the large and increasing number of people who do not aspire to a specialist's knowledge, but want a clear understanding of the general principles involved so as to be able to make simple designs and at any rate to be able to take an intelligent interest in reinforced concrete construction.

The author has endeavored to make the book simple, but at the same time to include complex considerations that are often omitted from books with this purpose. To design columns, monolithic with beams, without calculating eccentric stress due to the deflection of the beams, is to ignore an important factor. The author has endeavored to give a simple exposition of actual conditions without ignoring considerations of this kind.

Colorado vs. Wyoming

The article, "Pave Colorado Road with Precast Slabs," page 27 of the July issue of Concrete, should have read Pave Wyoming Road with Precast Slabs. The article itself should have read Wyoming, instead of Colorado, and Casper, Wyoming, instead of Casper, Colorado. This is one of those errors for which there is no legitimate excuse, errors nevertheless which sometimes regrettably happen.

Organizations

American Concrete Institute; Secretary, Harvey Whipple, 1807 East Grand Boulevard, Detroit. Convention, Cincinnati, Ohio, January 22-25, 1923.

American Concrete Pipe Association, M. W. Loving, Secretary, 111 West Washington St., Chicago.

Associated Metal Lath Manufacturers, Edison Bldg., Chicago; Wharton Clay, Commissioner.

Iowa Cement Stave Silo Association; H. E. Kilmer, Secretary, Oskaloosa, Ia.

Mid-West Concrete Products Assn., Frank Whipperman, Secretary-Treasurer, 3045 Fowler Bldg., Omaha, Neb.

National Crushed Stone Assn.; A. P. Sandles, Secretary, 405 Hartman Bldg., Columbus, Ohio.

National Housing Assn.; Lawrence Veiller, Secretary and Director, 105 East 22nd St., N. Y. C.

The National Lime Association; Mather Bldg., Washington, D. C.

National Sand and Gravel Producers' Association; E. Guy Sutton, Secretary, Williamsport, Ind.

The National Concrete Stave Silo Asociation; W. G. Kaiser, Secretary, 111 West Washington St., Chicago.